SCIENTIFIC AMERICAN

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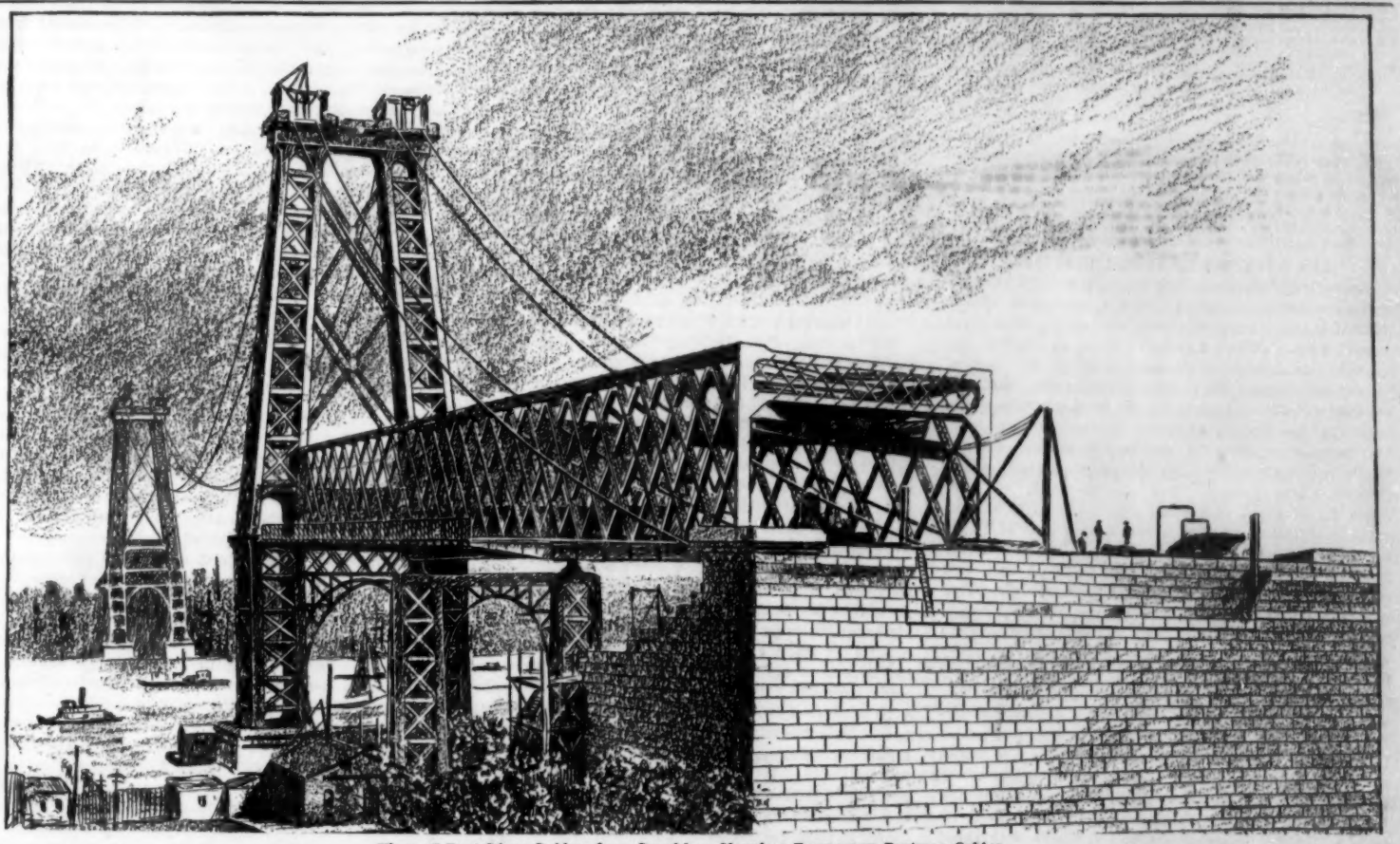
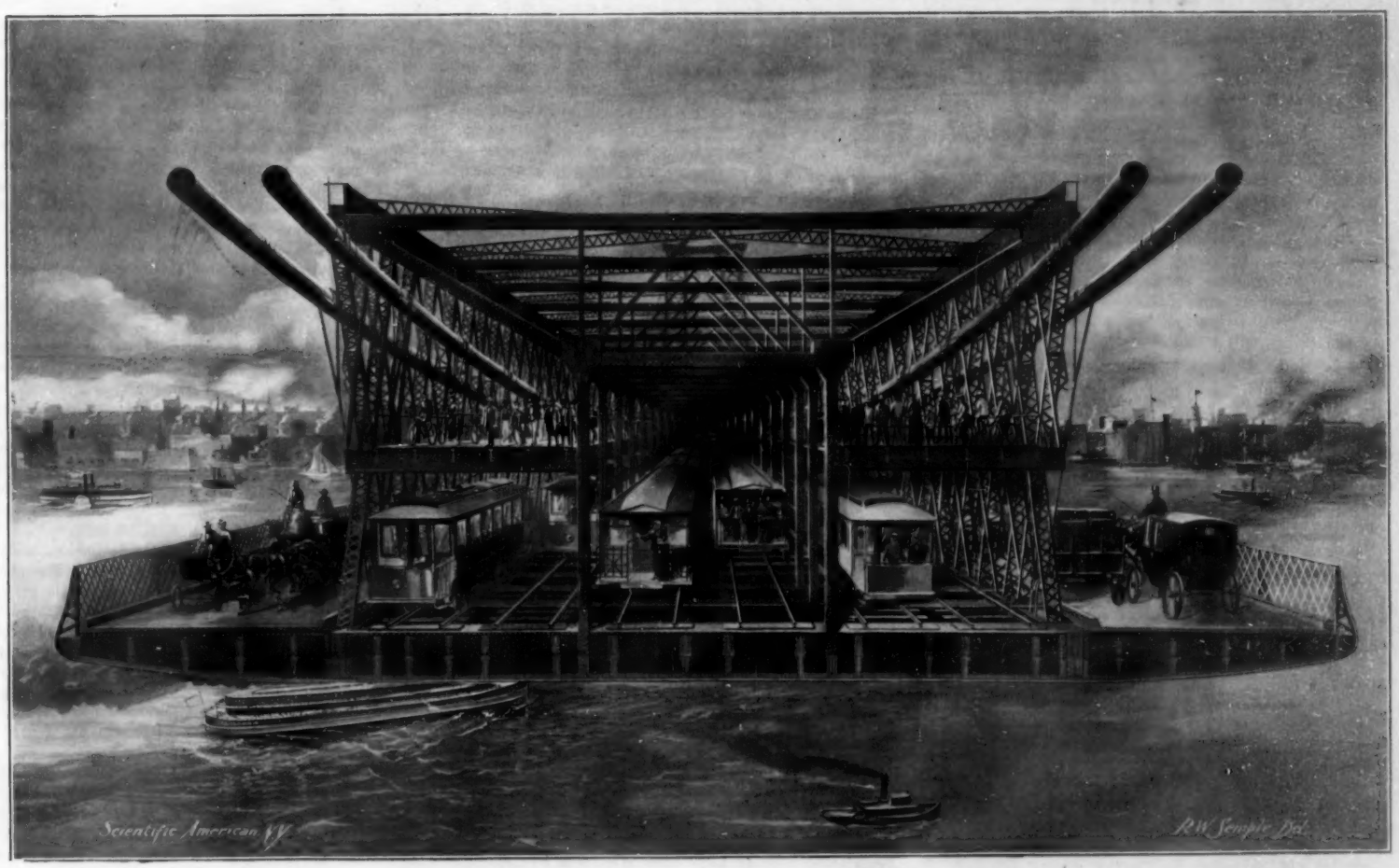


View of East River Bridge from Brooklyn, Showing Temporary Footway Cables.



Roadway. Bicycle track. Surface cars. Footway. Elevated cars. Footway. Surface cars. Bicycle track. Roadway.

Extreme Breadth, 118 Feet. Depth of Trusses, 40 Feet. Length of Main Span, 1,600 Feet.

THE FLOOR-SYSTEM OF THE NEW EAST RIVER BRIDGE.—[See page 374.]

Scientific American.

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NEW YORK, SATURDAY, JUNE 15, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rate.

THE GREATEST OF POWER STATIONS.

Undoubtedly the most interesting electrical installation now being carried out is the equipment of the Manhattan Elevated roads with electricity. The great power house, two hundred feet in width by four hundred feet in length, will be the largest in existence, and its compound engines will, we believe, without exception, be the largest single steam units to be found anywhere in service on land. The normal capacity of the power station will be 65,000 horse power, and the maximum capacity about 100,000 horse power. The steam plant will be made up of eight compound engines, which will be capable of running under a continuous load of 12,000 horse power each. These engines are of an entirely new type, and they are placed in pairs on each end of a shaft which carries a Westinghouse generator with a revolving field 32 feet in diameter and weighing 185 tons. The chief novelty of the engines consists in the fact that the high and low pressure cylinders are placed at ninety degrees, the high-pressure being horizontal and the low-pressure vertical. As there are two engines to each shaft, the turning moment is perfectly even, so much so that the customary flywheel is dispensed with, its place being taken by the heavy revolving field of the generator. The high-pressure cylinders are 44 inches and the low-pressure cylinders 60 inches in diameter, the common stroke being 88 inches. To find engines that will compare with these in size, we must refer to the engine rooms of some of the largest ocean steamships. The most powerful marine engines are those of the "Deutschland;" each quadruple expansion engine on this ship has indicated in twenty-four hours as high as 18,500 horse power, or 50 per cent more than the maximum capacity of the engines above described.

A COSTLY EQUIPMENT.

Apropos of the new power station of the Manhattan Railway Company, it is of interest to note that the mere electrical equipment of the rolling stock will cost just $3,000,000. Hitherto the motive power on the elevated system has been furnished entirely by steam locomotives, and the trains on the most important lines have averaged, during the rush hours, five cars in length. Under the new system the average length of the trains will be six cars, of which the leading and trailing cars will be equipped with motors. The General Electric system of train control will be used, the motor circuits on the motor cars being opened and closed by magnets which are themselves actuated by a train circuit under the direct control of the motorman. The electrically equipped experimental train, recently described in this journal, is running steadily on the Second Avenue line in this city, and valuable data as to cost of operation, etc., are being thereby secured.

RAPID TRANSIT TUNNEL TO BROOKLYN ASSURED.

Although the temporary delay to which the Rapid Transit Tunnel from New York to Brooklyn has been subjected by obstructionist tactics on the part of certain members of the Municipal Assembly of Brooklyn has been vexatious, it has served the good purpose of drawing forth from President Orr a masterly defense of the conduct of the affairs of the road by the Commission over which he presides. There is no question that President Orr's vindication will receive the unanimous approval of the citizens of Greater New York. It will be two or three months before the final survey of the tunnel is completed and the plans drawn up, but there is no reason why work should not be under full swing during the fall of this year. Without the Brooklyn tunnel the scheme would have been incomplete; but with this connection we may look for the time when the Brooklyn half of the Rapid Transit scheme will be as extensive as that in Manhattan Island, and only second to it in the density of its traffic.

THE WAVE LINE OF THE "GEORGIA."

As the result of a slight error in the numbering of the official plans which were furnished us from the Navy Department, Washington, the titles to the photographs showing the wave line of the model of the "Georgia," which were reproduced in our recent article on the model basin at Washington, are reversed. The wave line which is credited to a speed of 27½ knots actually accompanies a speed of 19 knots, and vice versa. The height and bulk of the bow wave vary, of course, with the speed, and are greater as the speed increases. In connection with these photographs, we would draw attention to the fact that the enormous piling up of water around the bow of the model at the higher speed affords a graphic evidence of the fact that the resistance to a vessel (and therefore the horse power required to drive her) increases as something more than the cube of the speed. Although surface or skin friction accounts for some of the ship's resistance, it is chiefly the displacement of the surface water in a vertical direction—the continual lifting of so much dead weight through such a height in such a time—that calls for rapidly-increasing expenditures of power at the higher speeds.

GERMANY'S FOREIGN TRADE IN MACHINERY.

The returns of the foreign trade of Germany for the year 1900, recently published, acquire particular interest from the fact that for the first time the imports and exports of machinery have been specialized. The total imports of this kind amounted to $18,639,360, an increase of $3,109,000 over the value of machinery imports in 1899. The value of the exports of machinery was $42,776,000, an increase of $500,000 during the year. As the statistics show the proportion of the import trade in machinery that comes from this country, we commend them to the attention of our manufacturers, as indicating the lines along which their efforts might be profitably expended in increasing our imports into Germany of articles which are now supplied almost exclusively by other countries. It is not surprising to learn that out of a total importation of 28,825 tons of agricultural machinery, over 20,000 tons came from the United States. Great Britain supplied a little over 5,000 tons, and the remainder was imported in relatively small amounts from half a dozen other European countries. The second largest item in the list is that of cotton spinning machinery, the imports of which amounted to 10,863 tons. As regards this commodity the conditions are entirely reversed, Great Britain contributing 9,876 tons and the United States nothing at all. Here, surely, is an industry to which our manufacturers might well turn their attention. The demand for cotton-spinning machinery is increasing rapidly all over the world, and many countries, such as Egypt, Turkey, Bulgaria and Greece, which up to the present time have imported large quantities of cotton goods, are now making a determined effort to establish cotton industries of their own. There is also a demand for cotton-spinning machinery in South America and the far East. The manufacture of cotton machinery seems to be to-day in a somewhat similar position to the tin-plate industry fifteen years ago. That is to say, it is practically non-existent, at least so far as the export trade is concerned. There is, of course, some exporting of cotton-spinning machinery to South America, but the sum total of our export trade in this most important branch of machinery is not at all commensurate with our exports in other branches of machinery. The statistics indicate that European countries place a high value upon the possibilities of foreign trade in this line, and consider that successful competition with Great Britain is quite feasible. Germany herself exported over four and a half million marks' worth of cotton-spinning machinery in the year 1900.

The imports of machine tools into Germany amounted to 6,270 tons, of which 4,757 tons came from the United States; but out of a total importation of 4,308 tons of locomotives and locomobiles our share amounted to only 189 tons, as against 3,196 tons (chiefly portable engines for agricultural work) imported from Great Britain. There is no doubt that the latter country excels in the manufacture of these engines; but there is nothing in the nature of the case to prevent the United States from supplying an agricultural portable engine which will be just as serviceable in its way as the agricultural machinery, in the manufacture and export of which this country is preeminent. Another item to which we would direct the attention of our manufacturers is that of electrical machinery, the imports of which into Germany amounted in 1900 to 4,350 tons, of which we contributed only 343 tons, as against an importation from Austria-Hungary of 2,080 tons and from Switzerland of 977 tons. We have already in these columns directed attention to the valuable work which the Budapest engineers are doing in the electrical field. Although our electrical exports to Great Britain and elsewhere are valuable and growing, it behooves our electrical manufacturers to study the possibilities of the Ganz high-pressure alternating system, which, it will be remembered, was at first adopted on its merits by the London underground roads in preference to the direct system, and was only finally rejected after a vote of a majority had been secured by those interested in the installation of the latter type.

Another export to which we might profitably turn our attention is that of weaving machinery. Out of a total of 8,184 tons, 6,138 tons were imported into Germany from Great Britain, 1,420 tons from Switzerland and nothing from this country. Summarizing the imports of lesser accounts: out of a total importation of 4,365 tons of steam engines, 1,738 tons came from Switzerland, 1,061 from Great Britain and 200 tons from the United States. Of 1,666 tons of lifting machinery, 574 tons were contributed by this country; of 1,055 tons of flour-milling machinery, 182 tons were contributed by the United States; while of 473 tons of rolling mill machinery, 77 tons came from this country.

An examination of the list of exports from Germany of machinery shows that Russia is by far the largest buyer of German goods. Thus of nineteen and a half million marks' worth of sewing machines, Russia was by far the largest buyer, as she was also of locomotives and portable engines, taking 4,024 tons out of a total export of 12,293 tons. Of 21,555 tons of steam engines, Russia purchased 5,586 tons and France 4,247 tons. The total export of electric machinery was about 13,000 tons, of which Russia again was the largest buyer, taking a total of 3,077 tons. Russia was also the largest buyer of agricultural machinery from Germany, taking about half of a total export of 13,000 tons. The exports of machine tools from Germany amounted to 9,267 tons, of which Russia purchased 2,370 tons and Austria-Hungary 1,236 tons. The full figures of Germany's machinery trade are given in an article in the current issue of the SUPPLEMENT, which we commend to the careful reading of our manufacturers in the special lines to which reference has been made above.

LAWS OF ABSORPTION OF X-RAYS FOR DIFFERENT BODIES.

M. Louis Benoist has lately made a series of experiments at the physical laboratory of the Sorbonne concerning the transparence of different bodies for X-rays. In a former series of experiments he showed that these rays are not homogenous and undergo a selective absorption by the different bodies traversed. In studying a certain number of bodies it appeared that the transparence to X-rays is not entirely a function of the mass, but that the absorbent power, or *specific opacity*, increases in general with the density. He showed also that different bodies possess a property which may be called radiochroism, as it is comparable with the coloration of substances which are transparent to light, and in virtue of which the relative opacity of two bodies changes with the mass traversed and with the nature of the X-rays used, the most rapid change taking place with the denser bodies. In continuing these researches he has studied about 120 different bodies, simple and compound, and has obtained results which enable him to deduce the principal laws of transparence of matter for X-rays. A prism of paraffin, 2-5 inch square at the base, and 3 inches long, is taken as a standard; its absorption for X-rays of a determined character is measured, and the absorption of other bodies compared with it by finding the length of a prism of the same base which will give the same absorption as the standard; the mass of this prism thus determines the *equivalent of transparence* of the body. This equivalence permits of calculating the mean specific opacity of the body for the thickness corresponding to that of the standard. The measurement of these equivalents brings out some interesting results, of which the principal are as follows: First, the specific opacity of a body appears to be independent of its physical state; for instance, it is the same for water and ice, it is independent of temperature, etc. Second, the specific opacity seems to be independent of the mode of atomic grouping of the body, that is, of crystalline forms, allotropic states, etc. (allowing for differences of purity); it is the same, for instance, for anhydrous alumina and corundum, for the different forms of carbon, crystalline and amorphous, for yellow and red phosphorus, etc., also for isomeric organic compounds. Third, it appears to be independent of the state of freedom of the atoms, and the equivalent of transparence of a mixture or combination may be calculated from those of the elements which compose it (taking account of possible difference of radiochroism); thus for silicon the equivalent measures 15.7, and for oxygen 44.5, from which that of quartz is calculated at 24, corresponding to the measured value, 24.1. In another case, caustic lithia measures 57 and oxygen 44.5, giving for lithia a calculated value of 113.8, the measured value being 115. The specific opacity for X-rays, measured under determined conditions, may be considered as a prop-

erty of bodies allied to that of atomic weight, atomic calorific capacity, etc. As it depends entirely upon the nature of the atoms, the experimenter sought a relation between it and the atomic weights of different bodies, and plots a curve which is quite regular, having somewhat the form of a hyperbola. This curve may be modified by varying the conditions of the experiment, which may be done in three different ways. First, by modifying the character of the X-ray tube; second, by changing the thickness of the standard, which causes, for the different bodies, a variation corresponding to their mass, and in consequence a more or less complete selection of the rays; third, by placing screens of different character in the path of the rays. A series of curves is thus obtained, varying with each experiment. By interposing various screens in the path of the rays, those of greater penetrative power may be sifted out, and it appears that these rays show nearly a direct proportionality between the specific opacity and atomic weight.

EXPECTED RETURN OF ENCKE'S COMET.

BY M. PROCTOR.

Among the periodic comets due in 1901 is Encke's comet, which is expected to return to perihelion about the middle of September. Its last return to perihelion took place on May 24, 1898, the same day on which it also occurred at the first predicted return in 1822. The prediction was made by Johann Franz Encke (after whom the comet has been named), and he detected the periodicity of the comet in 1819.

The comet had been frequently observed during the preceding fifty years, and as soon as the elements of its orbit had been computed and compared with the elements of the orbits of comets which had previously appeared, it was found to be the same comet which had been observed in 1786, 1795 and 1805. Having thus identified the comet at four different returns to perihelion, Encke was enabled to ascertain the period of its revolution with great precision, the result being 3½ years, the comet having the shortest known time of revolution and being the first of the short-period comets.

Encke predicted its return for 1822, making due allowance for planetary perturbations, and on account of its position in the heavens, he announced that the comet would only be visible in the southern heavens. The return of the comet was therefore looked for by astronomers living in that part of the world, and during the month of June was sighted by Rumker at Parramatta, in New South Wales. The next return was predicted to take place in 1825, and on the 13th of July—true to its appointed time—the comet was observed by Valz at Nismes.

The next return took place in 1828, when it was first seen by Struve, at Dorpat, in Russia, on the 13th of October of that year, and remained under observation at the European observatories until December 25. On November 7, 1828, Prof. Struve made a series of observations of the comet, and he noticed a star of the eleventh magnitude so near the center of brightness in the comet that he mistook it at first for the nucleus. The brightness of the star was not in the least perceptible degree diminished by the mass of cometary matter through which its light had passed. By November 30 the comet had greatly increased in brightness, and this must be ascribed to the contraction and consequent condensation of the nebulous matter of which it is composed, as it receded from the sun.

In 1832 the comet again returned to its perihelion, but being unfavorably situated for observation, it was only seen by Harding, at Göttingen, on the 21st of August. However, it was observed by Henderson, at the Cape of Good Hope, during the entire month of June, and was also seen at Buenos Ayres. In 1835 it was observed from July 22 till August 6, and in 1838 it was seen at Breslau on the 14th of August as a very faint, ill-defined object. It subsequently increased in brilliancy and continued visible until the middle of December.

In combining all the observations which had been made from 1786 to 1838 inclusive, Encke found that the period of revolution of the comet was regularly diminishing by about 2½ hours at each return to perihelion. This effect he attributed to the retarding action of a resisting medium in space. This theory seemed to be confirmed by observations made at the return of the comet in 1842, 1848, 1852, 1855, 1858, 1862 and up to 1868; but at its return in 1868 the acceleration had fallen to one-half its customary and, until then, constant value. The change has proved permanent, and accumulated facts bid fair to banish the theory of a "resisting medium" out of existence.

The comet has been seen at every return to perihelion lately, the dates of its visits being 1895, 1898, and it is now looked for in 1901. It has been described as irregular in form and "lumpy" in appearance, seldom showing a well-defined nucleus. Under very favorable circumstances it can be seen with the unaided eye, but is usually visible only in the telescope. It does not exhibit much in the way of jets and envelopes, and the train, when visible, is but a degree or two in length. As the comet approaches the sun, a peculiar contraction takes place in its volume, while it resumes its original dimensions when receding from the sun. For instance, at a distance of 130,000,000 miles from the sun, it has a diameter of nearly 300,000 miles, but when it is near perihelion (at a distance from the sun of only 33,000,000 miles), its diameter shrinks to 12,000 or 14,000 miles, the volume then being less than one-ten-thousandth of what it was when first seen.

According to Sir John Herschel, the explanation of this peculiar contraction in Encke's comet is optical rather than real, "that near the sun a part of the cometary matter becomes invisible, having been *evaporated*, perhaps, by the solar heat, just as a cloud of fog might be."

THE ST. LOUIS EXPOSITION OF 1903.

The preliminary work is progressing with much vigor at St. Louis for the Louisiana Purchase Exposition, and the current month will show the selection of a site for the Exposition. The organization is proceeding with the fully formed purpose of having the Exposition open on May 1, 1903. We are informed by the Secretary, Mr. W. B. Stevens, that work begins with a capital of $15,000,000, fully secured. In June, 1900, Congress made a part of the Sundry Civil Bill a section pledging an appropriation of $5,000,000 to the Exposition, if the organization of St. Louis should show, to the satisfaction of the Secretary of the Treasury, $5,000,000 raised by popular subscription and $5,000,000 of bonds voted by the city of St. Louis. At the following election in Missouri, November, 1900, the Constitution of the State was amended not only to permit the city of St. Louis to issue $5,000,000 in bonds, but also to authorize an appropriation of $1,000,000 by the State for its own participation in the Exposition. Since that election, the Legislature has carried out its part by making the appropriation of $1,000,000. The Municipal Assembly has by ordinance authorized the issue of bonds, and the people of St. Louis have subscribed for over $5,000,000 of stock. In February of this year, the Secretary of the Treasury was furnished with the evidence that subscriptions for the full amount stipulated by Congress had been secured, and that the bonds had been legally authorized. He certified these facts to Congress. A special committee reported the bill providing for an appropriation of $5,000,000, and the House passed it by more than a two-thirds vote. The action of Congress in appropriating $5,000,000 to the Exposition, making the government a financial partner to the extent of one-third, constituted the most notable provision yet made in the history of exposition legislation. President McKinley has appointed a government commission, and the first meeting has been held in St. Louis.

Those who have visited the Pan-American Exposition at Buffalo have admired the splendid arrangement, the architecture, the landscape gardening and the lighting. It is a triumph and exceeds any other Exposition in beauty. All this was accomplished with $5,800,000 capital and appropriations. With such a sum as $15,000,000 there is no question that St. Louis can give the most artistic though not the largest exposition ever held.

TWENTY-FIVE KNOT NAVAL SCOUTS.

At the Annual Conference of the Institution of Naval Architects in London, Rear Admiral C. C. P. Fitzgerald outlined a scheme he has had formulated for scout vessels of high speed and good seagoing qualities. His idea is by no means original, for the French government some two years ago sanctioned the construction of two such vessels for the purposes advocated by Rear Admiral Fitzgerald, although so far they have not been constructed. The vessel suggested by this officer would be a twin-screw steamer 400 feet in length, with a beam of 44 feet, 3,800 tonnage, draught 14 feet, 17,000 horse power, and a continuous ocean speed of 23 knots, rising, if the exigencies demanded it, to 25 knots per hour, a bunker capacity of 1,200 tons, and a normal supply of 500 tons of coal. She would be provided with a protective deck 2 inches thick on the slope, and would carry six 4-inch guns, with twelve machine guns. Although not intended for fighting purposes, she would yet be capable of defending herself against torpedo attack. The radius of action of this scout would be 1,500 miles at 25 knots, 2,000 miles at 23 knots, 3,000 miles at 18 knots, and 8,500 miles at from 10 to 15 knots. The maximum speed would enable her to escape from first-class cruisers. Her estimated cost would be $1,350,000. Commander Clover, of the United States Navy, who entered into the discussion, remarked that in the Spanish-American war the Americans employed liners such as the "New York" and "St. Paul" for this class of work, and they were found to fulfill all the necessary requisites, either as dispatch or scouting vessels. The result of their experience had convinced them that it was undesirable to construct special vessels as scouts, since in order to be efficient the vessels would have to be of large dimensions, so that high speed might be maintained at sea at all times.

SCIENCE NOTES.

The excavations in Carthage are producing excellent results. The Punic necropolis near the altar of St. Monica, at Carthage, has resulted in the finding of painted terra cottas, censers, figurines of women, bronze razors and engraved inscriptions of human beings, birds, etc., amulets of gold, silver and ivory.

The eminent French chemist, M. Armand Gautier, has reported a discovery to the Paris Academy of Sciences which may prove of great hygienic value. He has found that finely powdered volcanic stones, treated by boiling in water at a temperature of 250° to 300° Celsius, yield a liquid identical in composition with the ordinary sulphur water of mineral springs, except that it is stronger than the latter.

Dr. Harlow Brooks has been appointed pathologist to the New York Zoological Park. The animals furnish a splendid field for the study of comparative pathology. A laboratory will be fitted up for Dr. Brooks' use. He will make regular visits to the park to examine into the hygienic conditions of the animals and recommend such treatment, and to make such autopsies and microscopic studies as will tend to advance our knowledge of the prevention and treatment of diseases peculiar to animals.

Celluloid has always been manufactured by dissolving nitrocellulose in camphor—that is to say, forming a mixture of nitrocellulose, camphor and alcohol. But there are other ways of mixing it. According to a publication of the Société Générale pour la fabrication des matières plastiques de Paris, celluloid can be made by using naphthalene instead of camphor. The celluloid thus produced, the paper adds, is just as good as, if not better than, that in which camphor forms one of the ingredients.

The Surgeon-General of the United States Army has approved the report of a special medical board by which the conclusion was reached that the mosquito is responsible for the transmission of yellow fever, and the medical department of the army is moving energetically to put into practical operation the methods of treatment for prevention of yellow fever, involving a radical reversal of the existing methods, which form the basis of the report. The liberal use of coal oil to prevent the hatching of mosquito eggs is recommended.

German papers report that an Englishman, Mr. H. Houbon, has invented a process for making very pure hydrogen from acetylene. He condenses acetylene, in a Cailletet steel bomb up to 5 atmospheres, and ignites it by means of electricity. Hydrogen and carbon are formed; the latter precipitates in the form of fine soot. The process is without danger and makes it possible to generate hydrogen on a large scale very cheaply. This invention may mean much for balloon technics, as the present methods of making hydrogen are expensive.

Prof. Dr. Voges, the director of the National Board of Health at Buenos Ayres, according to German papers, has found a remedy for mosquito bites. He states that he discovered it by accident during his trip to Paraguay to study the pest. He had been supplied with all sorts of remedies, among them naphthalene, an article of no value whatever against the pest; but on using it for mosquito bites, he found it of surprising effect. It neutralizes the poison, even when the spot bitten is greatly inflamed. If fresh bites are rubbed with naphthalene, no swelling follows. The professor considers naphthalene almost a specific against mosquito poison.

The State of California has appropriated $250,000 to purchase and preserve the grove of redwoods near Santa Cruz. This excellent work was accomplished largely through the agency of a body of Californians especially organized for the purpose, called the Sempervirens Society. The area purchased is unfortunately not very large, and the finest redwoods are found further north. Several thousand acres of land will be purchased in the neighborhood of Humboldt Bay, running from the ocean back across the summit of the coast range. Two or three millions of dollars would be sufficient to make the entire purchase, and the government would do well to preserve this wonderful collection of forest trees for all time.

The heavy yoke of paternalism weighs on the pharmacists in Germany, says The American Druggist. Every detail of the practice of pharmacy is closely supervised by the government. No smoking, no loud and unnecessary conversation are allowed in stores and no domestic animal can be tolerated in them. The pharmacists are being gradually replaced by the "drogisten," who are only permitted to sell the simpler drugs and medical supplies, but cannot dispense prescriptions, and can only sell poisons under special restrictions for household use. Licensed pharmacists are required to be present in their stores from six A. M. to ten P. M., and during the night must be at all times ready to respond to the call of the applicant for even trifling amounts of drugs.

THE STEAM YACHT "LYSISTRATA."

The "Lysistrata" has the following dimensions: 285 feet load water line; breadth, molded, 39 feet 9 inches; depth, 24 feet to the main deck. She was designed by George L. Watson, and the decidedly unprepossessing look of the ship conveys the impression that the famous designer, whose yachts are renowned for their beauty, has had to work under unusual limitations. Mr. James Gordon Bennett, the owner, holds a master's certificate, and is supposed to be something of a critic of yacht design and yacht construction. If it was his aim to secure originality, it will be conceded that he has made a striking success.

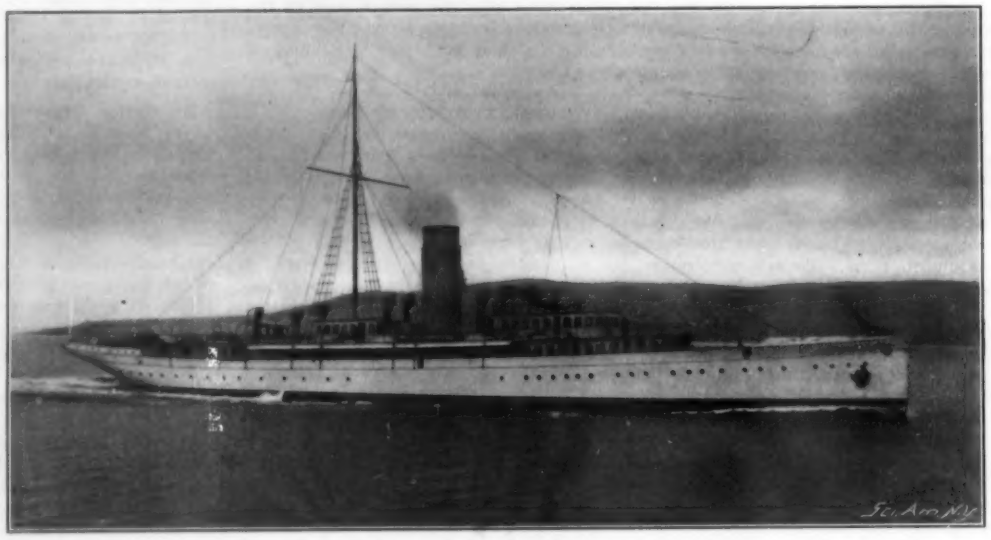
Yacht designing has of recent years run more and more in the direction of flowing curves and beautiful outlines. Clipper bows of long overhang and graceful curves, low waists with great spring in the sheer, and masts and funnel set at a considerable rake, have all been combined to beautify the models, with the result that the best of the modern yachts are undeniably graceful and pleasing. In "Lysistrata," however, the curving clipper bow has been discarded in favor of a straight stem, the sheer gives but a moderate rise fore and aft, the counter is long and looks longer through the absence of forward overhang; for spars there is only one mast perched abaft the funnel and a single yard, to be used for signaling purposes, and mast and funnel are set apparently plumb; though they have in reality rake enough to keep them from looking as if they were falling forward. The whole effect is odd and disappointing, though the result is said to be better in the actual vessel than in the illustration. In any case we sincerely hope that the "Lysistrata" will never be accepted as a model for our steam yachts; for we should be sorry to see the oddities which have been incorporated in this vessel repeated. The single mast with its yard and the general appearance of the bow are strongly suggestive of the yachts which were purchased by the navy during the Spanish war and transformed into scouts and lookout vessels. There were good reasons for the changes made; but it was the universal opinion that the beauty of the transformed yachts was almost entirely lost by the time they were in fighting trim. We fail to see any good reason why changes in yacht architecture which were due to the necessities of war should be perpetuated in time of peace.

The hull is of steel, and built to Lloyd's highest requirements, 100 A 1, under special survey. A double cellular bottom runs the whole length of the ship, and is divided into water-tight compartments so that it may be utilized for the carrying of water ballast. Over the hold there are five decks, and notwithstanding the exceptional amount of space given up to the boilers and engines the hull is made to provide ample accommodation for the owner, his guests, and the large staff required for the proper working of the ship.

Amidships a considerable amount of accommodation is given up to the casing of the boiler and engines, and here there is a novelty which should appeal strongly to those of the guests who desire to see more of the working of the ship than generally comes under the notice of the yachting guest. Under the main deck and above the engines there is a large open well. Round this is a spacious railed gallery from which the whole work of driving the ship can be studied. Aft of this there are more staterooms and stairways giving access to the lower decks. The main deck is finished with a full poop, and a low turtleback forecastle, and it must be admitted that the whole sweep presents an effect free from any suggestion of topheaviness or overloading. On the cabin deck the chief feature is the owner's principal stateroom, which is a specially spacious apartment measuring no less than 20 feet square. Forward of this there are four suites of staterooms, dressing-rooms, and bathrooms, all of them planned on a much roomier scale than is usually seen aboard ship. The lower decks are given up principally to the storerooms, though accommodation is found here for a few servants and crew.

The engines are triple expansion, in two sets, each with high-pressure, intermediate, and two low-pressure cylinders. They run with the utmost smoothness, and it was remarked in the course of the trials that it was almost impossible, in some parts of the ship, to tell when the engines had started. There are five boilers of the ordinary Scotch type, four being used for feeding the principal engines, while the other is used for the various auxiliary engines. No statement has been made as to the speed contracted for, but the trials were particularly thorough and exhaustive. Three full speed runs at full power were made between Cloch and Cumbrae, and the average speed obtained was 19.27 knots.

"Lysistrata" carries eight boats, three of them being steam launches, and the other five intended for propulsion by oars and sails. She has been provided with a very complete set of auxiliary engines, and is lit throughout by electricity. Practically the only concession to the custom of external decoration is in the immense owl carried as figurehead, and fitted in such a way that the eyes can be made to blaze with electric searchlights. From either side runs a scroll of carving, into which there has been wrought the owner's motto, "La nuit porte conseil."

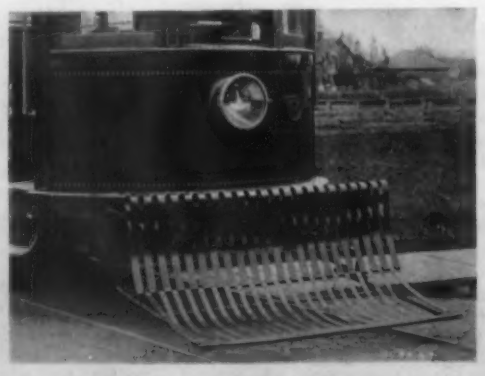


STEAM YACHT "LYSISTRATA."

Length, 285 feet. **Beam,** 39 feet 9 inches. **Depth,** 24 feet. **Speed,** 19.27 knots.

Theodosius F. Secor died recently, at the advanced age of ninety-two. He was one time a partner of the late Commodore Cornelius Vanderbilt, and was a pioneer marine engine builder. In 1848 he built the steamship "New World," which at that time was the fastest and largest vessel in this country. It was not until nearly thirty years later that a vessel with equal speed was built. Mr. Secor also built many of the Hudson River boats, as well as some for the Great Lakes.

Fender Completely Removed from Car.



Car-Fender in Operative Position.

Fender Raised.

VIEWS OF THE WATSON LIFE-GUARD.

AN EFFICIENT CAR-FENDER.

A life-guard which has successfully withstood the most severe tests to which it could be subjected on Canadian electric cars running at high speed is the subject of the illustration herewith reproduced. For the photographs from which these illustrations were made we are indebted to the inventor, Mr. William T. Watson, of Victoria, B. C.

The car-fender is composed of front and rear beds supported by a frame consisting of a relatively stationary rear section and a front section mounted to slide to and from the rear section. The rear bed is inclined; its upper end is attached to the car, while its lower end is located above the rear frame-section. To the lower end of this rear fender-bed, the front bed is hinged by its rear end. The front end of the front bed is attached to the sliding section of the frame.

The frame is supported by a transverse shaft mounted in brackets extending downward from the car. The transverse shaft is provided with upwardly-projecting arms located in the path of push-bars mounted to slide longitudinally beneath the car and connected with a spring-pressed rock-shaft. With this rock-shaft a rack-bar is connected, extending through the platform of the car. A holding-pawl is provided to lock the rack-bar. The rack-bar is operated by a foot-lever to throw the fender into operative position.

The two beds of the fender are yielding; and the force of a shock is still further broken by a rubber buffer on the front bed and by the fact that the front bed can slide back. In case of an emergency the gripman or motorman depresses the foot-lever which lifts the rack-bar, the holding-pawl engaging the teeth as they ascend through the platform and preventing the fender from rising. The push-bars beneath the car-bottom press outward on the upwardly-extending arms of the transverse shaft, causing the fender to drop at the front end. When the fender is to be raised back to its initial position, the holding-pawl is released from the rack-bar, the rock-shaft being turned by its spring. The fender can therefore be adjusted any desired height from the rails and locked against rising, but is not prevented from dropping from its own accord if any obstacle fall upon it.

The fender can be raised to any desired height while the car is running at full speed. Such is the mounting of the frame, that the entire fender can be removed with astonishing quickness. The fender can be applied to any car and operated from any point on the car. No time is lost at the end of a trip in adjusting the fender, for the motorman has only to operate his foot-lever.

Cement for South Africa.

Consul-General Guenther writes from Frankfort, April 15, 1901: According to official reports, South Africa is a good market for cement. All public buildings, stores, and dwellings are coated with cement. There are very few wooden buildings erected. The masons in South Africa are mostly Malays. They are skilled in their trade and do the work very neatly. Cement is also largely used in the construction of aqueducts, wharves, chimneys, walls, etc. While the principal import of cement is from Great Britain, considerable quantities are also imported from Belgium and Germany, the latter, on account of its cheapness, increasing. Belgium cement is of good quality and as cheap as the English article. The reports state that American cement could compete well, as transportation from our country is not higher than from Europe. Cement cannot be made in South Africa, for lack of raw material.

Minnesota State Legislature, in its last session, enacted a law that money may be loaned to fireproof grain elevators without insurance. The elevators must be passed upon as fireproof by the State Railway Commission.

THE ELECTROGRAPH—A NEW FACSIMILE TELEGRAPH.

Facsimile telegraphs are by no means new. Pictures, handwriting and printed matter have often enough been electrically transmitted from one station and accurately reproduced at a second. But the instruments whereby the transmission and reception of a character or sign is effected have not been noteworthy for their simplicity or for their speed. Moreover, it is usually necessary to employ, either at the transmitting end or at the receiving end of the line, chemically-prepared paper or tissue to receive the pictorial message. A reproduction thus made cannot be photo-engraved clearly, hence is not practical for newspaper work. Among the inventions exhibited by the United States Patent Office at the Pan-American Exposition may be found a facsimile telegraph which certainly marks a noteworthy advance in the art of transmitting pictures electrically, and shows no little ingenuity on the part of its inventors in endeavoring to overcome the objections which we have cited. The construction of the machine is not complex; the speed of transmission is considerably greater than has ever been previously attained by a facsimile telegraph; and the necessity of employing a chemically-treated paper is obviated. The transmitting and receiving machines nowise differ in construction; hence, one instrument can be used either for sending or for receiving a picture or a message.

The electrograph, as this new machine is called, is the invention of Herbert R. Palmer, M. E., Thomas Mills and Dr. William P. DunLany, and is made by the International Electrograph Company, of Cleveland, Ohio. The instrument consists of a substantial metal frame carrying a 110-volt, direct-current electric motor, the armature-shaft of which is connected by a reducing-gear with the shaft of a rotatable cylinder. The several gear wheels employed constitute a variable speed-gear, the elements of which are thrown into and out of mesh by means of a friction clutch in order to vary the speed of the cylinder's rotation. On its surface the cylinder carries either a transmitting or a receiving sheet (similar instruments being used at both the transmitting and receiving stations). In the machine illustrated the transmitting sheet is a zinc enlargement of a half-tone plate, the variations in the surface of the zinc sheet being considerably more pronounced than those of the smaller original, so that the transmission of the picture is facilitated. For newspaper work the enlarged picture received at the second station is to be reduced. Into the depressed portions of the zinc enlargement, corresponding with the etched portions of the original half-tone, an insulating material is filled. Thus treated, the zinc sheet presents a fairly smooth, partially metallic and partially insulated surface.

The filled zinc plate is curled around the cylinder of the transmitting machine; and upon the surface of the zinc plate glides a stylus which is caused to travel along the rotating cylinder by a carriage, very much as the reproducing stylus of a phonograph is caused to travel along a sound-record. Thus, the stylus comes into contact with every portion of the cylinder surface, describing a continuous spiral as the cylinder rotates and the carriage travels. Upon a piece of ordinary paper wrapped upon the cylinder of the receiving instrument, many hundred miles away, plays an inked pen which, like the transmitting stylus, is caused to travel along the paper of the rotating receiving-cylinder. Since the same instrument can be used whether for transmitting or receiving messages, the carriage is provided with both a stylus and a pen, so mounted that either can be thrown into or out of operative position. The stylus, as the cylinder rotates, glides over a surface partially metallic, partially insulated. When in contact with the metal, the circuit through the line and receiving instrument is completed, and a line or dot is traced by the pen of the reproducing instrument corresponding in length with that traced by the transmitting stylus. When the stylus is in contact with an insulated portion of the zinc sheet, the circuit is broken and the pen of the receiving instrument is withdrawn from the paper. The pen of the receiving machine is actuated by electro-magnetic coils, affected by the make and break of the circuit, reproducing the dots of the half-tone plates. These coils are operated up to a speed of 150 impulses per second without perceptible lag, and without a retracting spring. The pen is lifted from the paper with a speed equal to that of its closing impulse. In this way, high speeds with very weak currents can be attained. This is accomplished by opposing to the main operating coils a pair of smaller coils, shown in detail in Fig. 1. Both coils are electrically in series, and energized at the same instant. The armature, carrying a common steel pen, vibrates between these opposing coils. The main, or recording, coils are wound upon cores of soft Swedish iron, while the others have cores slightly harder, with a greater magnetic lag. The effect produced by the current energizing the coils at the same instant is to pull the armature toward the quicker, the recording pair, where it is firmly held, owing to its increased distance from the opposing pair. On breaking the current the recording coils, discharging first, weaken sufficiently to enable the magnetism still remaining in the opposing coils to withdraw the armature to its original position. Hence a retracting spring is not necessary, and the current, having no force to overcome while producing motion in the armature, can be very weak, and still make a perfectly black ink mark on the paper, an operation much appreciated by telegraph engineers.

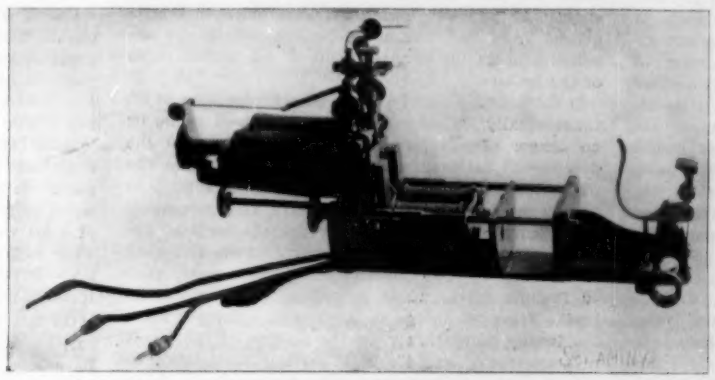


Fig. 1.—THE CARRIAGE, SHOWING MAGNETIC COILS, STYLUS, AND PEN.

Fig. 2.—PORTRAIT OF PRESIDENT LOW, TRANSMITTED BY THE ELECTROGRAPH. (Reduced.)

Good results are secured with a current of 110 volts passed through 20,000 ohms of line resistance, which is equal to 4,000 miles of No. 10 copper circuit, earth return. The internal resistance of the machine is 250 ohms. Over an actual telegraphic line some 770 miles in length, extending from St. Louis to Cleveland, by way of Chicago, the machines operated faultlessly. When Western Union telegraphic repeaters are used the speed of transmission is reduced by two-thirds; but in ordinary transmission it is customary to cut out all repeaters.

It is clearly necessary to synchronize the two rotating cylinders so that the picture may be exactly reproduced. For this purpose resistance-coils are employed, which can be cut in and out of the field of the motor, together with a simple synchronizing device. The synchronizing is effected by an automatic three-way key, which cuts synchronizing coils into the circuit once during each rotation of the cylinder. The fast cylinder stops, and starts immediately upon closing the automatic key in the slow machine. The completion of the circuit which thereby results opens a lock on both machines, starting both cylinders at the same instant. All differences of speed are corrected at the end of each revolution. An accumulation of errors is, therefore, obviated.

A picture is sent at the rate of one inch per minute

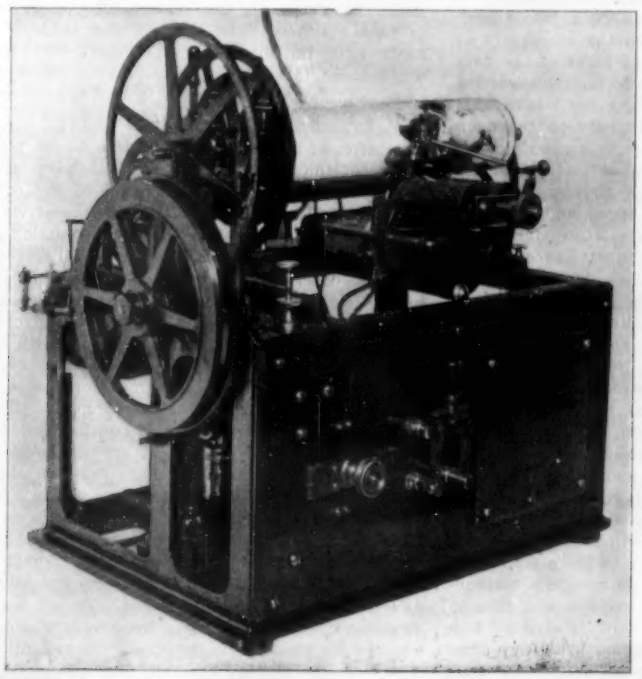


Fig. 3.—FRONT VIEW OF ELECTROGRAPH.

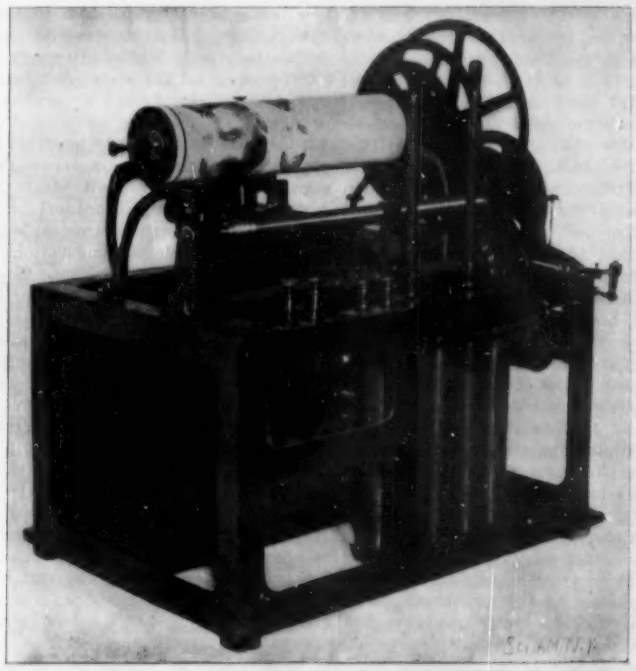


Fig. 4.—REAR VIEW OF ELECTROGRAPH.

of the cylinder length; that is, a picture or cut which occupies the whole length of the cylinder, 8 inches, will be transmitted in 8 minutes time. In the reproduction of a very fine-meshed picture, the stylus of the transmitting machine and the pen of the receiving machine will rule 80 lines per inch. Coarser pictures are transmitted at the rate of 40 lines per inch, or in 4 minutes. The space occupied by a cut in a newspaper could be filled by an equivalent number of words telegraphed by an ordinary operator at a speed of 25 or 30 words per minute. Hence, the time required in transmitting a picture by means of the electrograph is exactly the same as that consumed in telegraphing a verbal message. About 40 minutes are required to prepare the zinc plate for transmission and about 30 minutes to prepare the picture reproduced by the receiving machine for newspaper printing. On a 1,500-mile circuit 80 minutes suffice to prepare a zinc enlargement, transmit the picture, and reduce the picture reproduced for the press. Of this time not more than 10 minutes are consumed in transmission. Machines with cylinders thirty inches in length, having two carriages, are now in the course of construction and are to be used in duplex transmission, one picture being sent simultaneously each way over a single wire. A machine thus receives and sends a picture at the same instant. With two instruments at each end of the line, a quadruplex transmission is possible, four pictures being sent over the wire simultaneously. Thus the average time of transmitting a picture is reduced to two minutes' wire service. That these speeds can be practically attained has been proven time and time again by severe tests made over the Western Union, American Telephone and Telegraph Company, and the Associated Press wires.

FLOOR SYSTEM OF THE NEW EAST RIVER BRIDGE.

In comparing the greatest bridges of the world—and it seems as though we can only arrive at a correct idea of the proportions of one of these great structures by expressing it in terms of some other one—it is impossible to say of any particular bridge that it is, in the total, the greatest of its kind. One bridge may have the longest single span, and another the greatest number of extremely long spans; to another may belong the distinction of having the greatest carrying capacity, while a fourth may be distinguished by the magnitude of certain parts, such as the foundations, which are entirely hidden from view. In respect of the length of its main span, the present Brooklyn Suspension Bridge is practically the equal of the new East River Bridge, the new structure having a span of 1,600 feet between towers and the older bridge being five or six feet less. In over-all measurement, indeed, the Brooklyn Bridge greatly exceeds the new structure, the distance from anchorage to anchorage being 3,455 feet 6 inches, whereas the distance between anchorages of the East River Bridge is about 675 feet less than this. Although the total length of the steel structure of a bridge is what we might call the most spectacular feature of its measurement, the true test of the capacity of these modern, long-span bridges is the width of the floor system, or its capacity for traffic. Judged on this basis, the new East River Bridge is considerably the largest structure of its kind in the world.

With a view to giving the reader an adequate impression of the carrying power of the new bridge, our artist has prepared the cross-sectional view which is found on the front page of this issue. The section is supposed to be taken at a point about a third way across the main span, starting from the Brooklyn tower. As the parts of the bridge at the point of section are shown to exact scale, the drawing not merely affords an admirable perspective view of the finished structure, as it will appear to a passenger in crossing the bridge, but it shows with great detail the exact proportion of the various members, the method in which they are assembled, and the functions which they severally perform. For purposes of comparison it may be mentioned that the extreme breadth of the suspended structure of the Brooklyn Bridge is 85 feet; whereas the extreme width of the floor of the new East River Bridge will be 118 feet. The total width of the latter is about evenly divided into five separate roadways. Of these, the center roadway, which is devoted to the elevated cars, contains two tracks, one for east-bound and the other for west-bound traffic. On each side of the elevated tracks are two street-railway car tracks, while beyond these, on the extreme outside of the bridge, are two carriage roadways. Above the street railway tracks are two platforms, each divided at about its center by an iron railing. Of the four roadways thus formed those on the outside are devoted to bicycle traffic, while the inside roadways are given up to foot passengers.

The great load of the suspended roadway is carried by four steel wire cables, in each of which there are 10,397 wires, 0.165 inch in diameter. The wire has a breaking strength of 100 tons to the square inch. The floor system is suspended from these cables by steel wire ropes, 1¾ inches in diameter, which are carried up and over steel saddles clamped upon the main cables. Each suspending cable is continuous; that is to say, it is carried over the cable saddle and below a bottom suspension saddle, the two ends being coupled in a sleeve. Two heavy inverted steel U-bolts depend from each bottom suspension saddle and are bolted beneath the covering plate of the bottom cords of the trusses.

If the floor system of a suspension bridge were at all times equally loaded from end to end, there would be no danger of a deformation of the cables, and the floor would maintain a true surface. But since the traffic is liable to be concentrated or "bunched" at one or more positions on the bridge, it is necessary to stiffen the floor system to resist the vertical distortion which would otherwise result. This stiffening is afforded by two massive stiffening-trusses, each 40 feet in depth, which extend entirely across the bridge from anchorage to anchorage. These trusses are located immediately on the outside of the street railway tracks, and lie in a vertical plane between them and the carriageways. The bottom chord of the truss is of the same depth as the floor system into which it is built, and with which it is firmly incorporated. The floor proper of the bridge consists of a series of transverse plate-steel girders, 5 feet in depth, which extend entirely across the floor from side to side. These girders are placed 20 feet apart and the gaps between them are bridged longitudinally by lines of plate-steel stringers, of about half the depth of the floor beams. There are twenty of these lines of stringers counted across the width of the bridge, and they extend entirely throughout the structure from end to end. The load of the roadways is carried by the overhanging, cantilever-like, ends of the floor beams, and the middle portion of the floor beams between the stiffening trusses is supported at two intermediate points from a series of overhead trusses, which are built in between opposite panel-points of the top chords, at every 20 feet of the length of the bridge. The advantage of this method of construction is that it saves weight, and also enables the floor beams to be made many feet shallower than they would have to be were they not thus supported.

The stiffening trusses are constructed on the riveted system in preference to the eyebar system, which was at one time so greatly in vogue as to be considered the typical American construction. As a matter of fact, in the whole of this bridge, there is not, as far as we know, a single eyebar used, except at the anchorages, where eyebar chains extend through the masonry to take hold of the anchorage platforms. The web members of the stiffening trusses are arranged on the triple-intersection plan and they consist, as do also the members of the lateral system, of heavy angles placed back to back and latticed together. The bicycle and foot-passenger platforms are carried upon plate steel floor beams which are supported at their outer ends by the web members of the stiffening trusses and at their inner ends are riveted to the vertical ties connecting the overhead trusses with the floor beams.

In a suspended structure of this great span, presenting such a large total area to the pressure of the wind, it becomes necessary to make special provision to resist wind stresses. As far as the floor system is concerned, this provision consists of a heavy horizontal system of trussing between the top chords of the stiffening trusses, while in the plane of the floor of the bridge sufficient resistance to lateral distortion is afforded by the manner in which the longitudinal stringers are riveted intercostally between the floor-beams; the tensional stresses, due to a wind blowing transversely across the bridge being resisted in the leeward half of the floor by the stringers and the bottom chord of the stiffening truss, and the compressive stresses being similarly resisted by the stringers and bottom chord of the windward half of the floor system. The wind stresses are also resisted by the "cradling" or inclining together of the cables.

The upper view of the East River Bridge on our front page was taken from a position slightly to the rear and to the side of the Brooklyn anchorage. The cables, which are shown stretched in position, are those which have been strung for the purpose of carrying the temporary platform, from which the four main cables will be constructed. The latter will be assembled and the wrappings and clamps put on at an elevation slightly higher than that at which they will be finally suspended. When they are completed the temporary platform cables will be removed, and the main cables will be lowered to their permanent position. The next step will be to hang the suspending cables upon the main cable saddles, and then to the lower end of these will be gradually attached and built together the heavy framework of intersecting floorbeams and stringers. Upon the foundation thus prepared will be erected the great 40-foot stiffening trusses, with their intermediate trusses for carrying the railway tracks and the passenger platforms.

Engineering Notes.

A large seven-story building in Chicago has just been raised without cracking a pane of glass or marring a wall. The building was raised 21½ feet with the aid of a steel sub-structure and 1,500 jacks. The work was completed in twenty-one days.

Consul General Guenther, of Frankfort, reports that on the 20th of March official tests of so-called fireproof stairs for apartment houses were made at the yards of one of the fire-department stations in Frankfort, where intense fires had been started for the purpose. The stairs covered with plastering showed the longest resistance and could still be used after being subjected to the fire for twenty-five minutes. Of stairs coated with fireproof paints, no tangible results could be stated, as the stairs experimented with were of great variety as to material and strength; but they were still serviceable after five or ten minutes under fire. Of the wooden stairs without fireproof paints, those of oak withstood the fire the longest.

On March 1 a mail train, consisting of engine, mail car, baggage car, and sleeping car, was run over the Savannah, Florida & Western Railroad from Fleming, 24 miles south of Savannah, to Jacksonville, Fla., 149 miles, in 130 minutes, or at the rate of 68.8 miles an hour. This time includes one stop, and there were two other places where speed had to be slackened. It is stated, says The Railroad Gazette, that the time taken in covering five miles between the sixty-ninth and the seventy-fourth milestones was 2 minutes 30 seconds, a speed of 120 miles an hour. The engine was a ten-wheeler, burning bituminous coal. It weighs 65 tons, of which 48 tons is on the drivers. The cylinders are 19 inches by 28 inches, and the driving wheels are 73 inches in diameter. The boiler is the extended wagon-top type, with 300 flues 2 inches diameter and 14 feet long.

An expedition of a private character dispatched from Norway last summer to Spitzbergen to exploit the coalfields there, has returned to Throndhjem with good results. In Advent Bay large coalfields were discovered and seized, and some 500 hectoliters brought home as a sample. The coals, which are said to resemble anthracite, are reported by experts to be of good quality. A company is in course of formation in Throndhjem in order to work these coalfields. In addition, a cargo of coals has been brought from the well-known deposit at Cape Boheman, and they have been tried on the state railways and otherwise. The drawback to these coals is, however, that they leave a very large quantity of porous slag in the furnaces, and are quite unsuitable for locomotives. The slag, or deposit, of scoria would also prevent the use of the coals for domestic and factory purposes.

A machine for extinguishing fires in ships' holds recently introduced into Great Britain depends for its action on the generation of sulphurous acid gas, which is forced into the chamber in which the conflagration has occurred, and which, by replacing the air, so vitiates the atmosphere that combustion cannot continue. The machine consists of a generating chamber, into which air is forced by a fan, and in which a store of sulphur is placed. This can be simply ignited by throwing upon it a piece of burning waste. The gas thus generated is forced into the chamber, and after a while extinguishes the flames. Attached to the apparatus is also a condenser, by means of which, the fire once extinguished, the gas is passed through and through the chamber as it cools, until the materials which have been burning are reduced to such a temperature that they do not burst into flame when the air is at length introduced. This is brought about by a gradual process.

A series of interesting experiments on the explosive effects of the modern infantry bullet have been carried out in Germany by C. Cranz and K. R. Koch, says Nature, London. They used a new Mauser rifle of 6 millimeter (¼ inch) bore, having a muzzle velocity 100 meters (328 feet) greater than model 88. To imitate the effect upon large bloodvessels, while at the same time obtaining simple physical conditions, the experimenters constructed short, hollow tin cylinders filled with water, and closed at one end with a sheet of rubber and at the other with a sheet of parchment paper. Electrodes were mounted before or behind the cylinders, or inside them, and the discharge spark produced by the bullet was utilized to obtain a photograph of its silhouette at various points of its path. Among the important facts thus elicited it appears that the body struck is not displaced by the entry of the bullet. On leaving the body, the bullet carries away with it a small part of the hind surface, having a small round perforation through which the bullet passed. The explosion does not take place until the bullet has left the body. After discussing the evaporation, hydraulic pressure, rotation, and sound-wave theories of the explosion, and discarding them all, the authors conclude that the apparent explosion is due to the transfer of kinetic energy to the portions hit at later stages, which are thus torn away from those first encountered.

Correspondence.

Sun Motors for India.

To the Editor of the SCIENTIFIC AMERICAN:

In one of the recent issues of your paper which has come to hand is found the article, with illustrations, on solar motors. This has proved of great interest to me, as the thought has suggested itself time and again in this severe famine, "Why cannot some means be employed for the utilization of the fierce heat of the sun for the purpose of pumping water?" This article goes to show that the day is not far distant when a great deal of heat will be derived from the sun.

I shall watch with keen interest the development of the solar motors and do what I can to let it be known here that the Americans are successfully creating power from the sun's rays.

Undoubtedly these motors will command world-wide attention, as there are vast tracts of territory where the cloud percentage is very small and where, could power but be obtained, "the desert would bloom as the rose." In this portion of India the season in which water is most sorely needed, especially after the failure of the rains, is called "sun time." The percentage of sunshine is very high.

A few figures from some experiments I have made with respect to the power of the sun may be of interest to those who are constructing the "motors." From these it would appear that the heating power of the motors would be increased should the "magic circle," or possibly the entire middle portion of the motor be incased with glass.

The following are the figures recorded on three separate days, with an ordinary thermometer, in the sun at midday, and the temperature in a cardboard box covered with glass. Had a tin box been used a still greater difference would have been recorded:

	In Sun.	In Glass-Covered Box.	
April 17, 1901	130°	157°	= + 31
April 19, 1901	130°	157°	= + 27
April 22, 1901	127°	159°	= + 32

From these it will be seen that the temperature in the box was from 27° to 32° higher than in the open air. Should the temperature in the "magic circle" be raised from 27° to 32° by simply incasing the same in glass, undoubtedly better results would be obtained.

REV. WALTER T. SCUDDER.

Vellare, India, Madras Pres., May 1, 1901.

Meteor Seen in Daylight.

A remarkable phenomenon, that of a meteor seen in daylight, was observed in different localities in the northwest of Germany on the 16th of December last. According to the indications furnished by Das Wetter, the meteor was observed about 4.40 P. M., near 45° above the horizon, in the direction south-southeast. It appeared under the form of a large mass of a brilliant and rather violet hue; it moved in an arc which was somewhat inflected toward the horizon, in the direction southwest. The meteor disappeared at or near the horizon, according to the different reports. The light was quite intense, as may be remarked from the fact that even in daylight the phenomenon was mistaken for that of lightning. The observers agree in attributing to the meteor an elongated and pointed form, but this may have resulted from an optical illusion due to the movement. The meteor in its passage through the atmosphere left behind it a great quantity of smoke or vapor, which was visible in the form of clouds extending nearly five minutes of arc in length behind it. These clouds, which were visible in spite of the rays of the sun, which had not set, followed the path of the meteor at first, but then moved toward the east in the direction of the wind, and gradually settled down, this no doubt being due to the weight of the particles composing them.

A Derailment That Damaged a Pond.

A curious case was brought before the Supreme Court of Pennsylvania recently, says The Railway Gazette. Plaintiffs owned an ice pond and brought an action for $7,500 damage to 15,000 tons of ice, due to 6,000 gallons of oil from an oil tank car which had been derailed. The derailment, according to the evidence, was not due to any fault on the part of the defendant. The oil ran through a break in the tank at the rate of two gallons a minute, and flowed into plaintiff's pond. The defendant used every effort to pump the oil from the car into another car without success, and at the end of eleven hours from the time of the accident, the defendant, finding that nothing could be done to save the oil, opened the valve at the bottom of the tank and let it all run out. The court said, in refusing to permit a recovery by the plaintiff, that as the quantity of oil which had already flowed into the stream was sufficient to render the ice made from its waters useless, letting out the remaining oil is an insignificant fact, and cannot be said to be sufficient to place the responsibility on the defendant. (Commercial Ice Co. vs. Reading.)

Electrical Notes.

Germany and Holland are planning to lay a new cable to connect with the Dutch East Indies.

There are now in Italy 3,179 kilometers of street tramways worked by mechanical power, 263 kilometers of these by electricity, and the remainder by steam power. They are owned by 64 companies and private concerns. The town of Milan owns only 5½ kilometers, while the two largest companies control 261 and 205 kilometers respectively.

A committee of experts appointed by Postmaster-General Smith, which investigated the workings of the pneumatic tube systems of carrying mails in cities, has reported its conclusions that on the present basis of cost the system is too expensive. They say, however, that a system to be operated by electricity is in process of development and bids fair to be successful. It essentially consists of a miniature third-rail trolley road operated in a tube.

A large electric plant is being erected at Bibi-Eybat, near Baku, which is intended to supply power and light for the whole district where boring operations are carried on. There are four dynamos of 500 kilowatts and 2,000 volts each. All the necessary work, including boring, will be done with electric motors, and these are of a particular construction. Great care is taken to exclude the highly inflammable gas, rising from the borings, from the motors and other parts likely to cause an explosion.

At a meeting of the German Auer Company, held some time back, it was announced that Dr. Auer had succeeded in making an electric lamp with a filament of osmium, says The Trade Journals Review. It was further stated that laboratory experiments showed this lamp to take but 1.5 watts per candle power, and that the average life would be not less than 700 hours. The lamp works best, it is said, with a small electromotive force, 25 to 50 volts at most. This, while an inconvenience in most cases, has advantages when the lighting current is supplied by batteries, since fewer cells are needed.

A light electric railway for passengers and goods traffic in Russian Poland, connecting the towns of Lodz, Zgierz, and Pabianice, is now open. Its length is about 21 kilometers, and the electric plant has been built in Russia. The line is owned by a company consisting of Polish manufacturers and merchants, and has cost about £80,000. The building of this railway has been granted by the Russian government on the conditions that after twenty-eight years the whole line and plant is to be handed over to the government without any compensation, and that after twenty years it has the option of purchase. Furthermore, the company has agreed to pay a certain portion of the profits to the government. This line is interesting, as it is the first electric railway established in Russia.

Several French syndicates have planned the development of the water power of the Rhone, and extensive plants are to be erected within the next three years between Pyrimont and the Swiss frontier. The first of these projects is that of Malpertuis, 2½ miles below Bellegarde, where the river falls thirty to thirty-five feet, with perpendicular banks only 160 feet apart. By building a tunnel one-half mile long, a total fall of fifty-one to fifty-five feet can be secured, equivalent to 25,000 horse power, at low water. Near Bellegarde another tunnel would secure a fall of eighty to eighty-five feet, developing 30,000 horse power. And about eight miles from the Swiss frontier is a narrow gorge only 80 feet wide, and a dam built here would give a fall of sixty-five feet, or 30,000 horse power, at low water.

It has been noticed in certain parts of America and in India, that during thunderstorms incandescent lamps that are alight suddenly brighten up very considerably, in some cases sufficiently to break the filament; and in some cases the brightening is followed by the lamp's giving an inferior light to that which it gave previously to the storm. It has been suggested that this phenomenon is due to a similar action to that which takes place in the coherer, which is used in the high-tension form of wireless telegraphy, viz., a closing up of the molecules, and a corresponding decrease of the electrical resistance of the filament, this having been observed in coherers, when thunderstorms have passed over the places where they were fixed. It appears more likely, however, that it is due to pressures induced by the passage of charged clouds over the lines connected to the lamps, the increased brightening taking place when the induced pressures were in accord with the service pressures.

Robinson Crusoe's Gun.

A Philadelphia firm of auctioneers recently offered at one of their sales Robinson Crusoe's musket. It was a fine old flintlock. It was in the possession of a grandniece of Alexander Selkirk, and its pedigree is much more unclouded than is usually the case with objects of this kind.

Automobile News.

The progress of the automobile industry in France will be seen from the following table, which gives the figures for imports and exports of automobiles, cycles, as well as private carriages, for the years 1898, 1899 and 1900:

IMPORTATION.	1898.	1899.	1900.
Automobiles	$79,010	$94,530	$101,800
Cycles and motocycles	1,785,060	1,588,810	1,107,360
Carriages	172,870	159,960	122,400
EXPORTATION.			
Automobiles	$349,870	$851,860	$1,882,000
Cycles and motocycles	2,132,800	2,030,710	1,583,800
Carriages	431,460	834,800	610,720

It will be seen from the table that the figures for the imports and exports of last year have diminished for cycles and motocycles, as well as for carriages. The figures for automobiles, while increasing somewhat in importation, have more than doubled in exportation. It is estimated that more than 3,000 workmen, at a mean of $1.60 per day, have been occupied during the whole of last year upon foreign orders alone. It will thus be seen that the automobile industry is in a flourishing condition.

The Paris-Berlin and Paris-Bordeaux are the two next important races; the latter includes the Gordon Bennett Cup, which will be run on the same day. The Paris-Berlin has been organized by the Automobile Clubs of France and Germany, in connection with the Belgian Club and the Union of German Automobile Clubs. The distance will be covered in three stages. 1. 27th of June, Paris-Aix-la-Chapelle, starting at 3:30 A. M. 2. Aix-la-Chapelle-Hanover, the following day; start at 5 A. M. 3. Hanover-Berlin, the 29th, starting at 5 A. M. After the machines arrive at Berlin they will be taken to a large building which has been prepared, and will form part of an automobile show to be held on the 30th of June and the following day. The race is international, and includes the usual four classes of moto-cycles, voiturettes, light and regular machines; the last two classes carry at least two persons, representing 154 pounds each. Engagements may be made up to the 25th of June ($10 to $60, according to class), but this is doubled after the 27th of May. A considerable number of entries have been made up to the 12th of May, including Charron, Levegh, De Knyff, Heath, Count de Chasseloup-Laubat, Girardot, Count Zborowsky, etc., with petroleum machines; Jenatzy, with an electric racer; Serpollet (steam system), and others.

The Automobile Club of Great Britain has organized a competitive test of automobiles for the 13th of April, which takes the place of the first test of alcohol motors, this having been postponed to a later date. In the present tests the speed of the machines is not taken into account, but only their general performance. The meeting of the participants takes place at the Sheen House Club, and the start is at 2:30 P. M. The route includes a part of Richmond Park to Robin Hood Gate, Kingston, Esher, Cobham, Weybridge Road and return by Hersham, High Road, Roehampton Lane and Richmond Road, arriving at the starting point after having covered exactly 30 miles. The event is terminated by a dinner given at the Sheen House Club, in which the organizers and competitors are united. As regards the three-monthly tour for the Hundred Miles Record, organized by the Automobile Club for the 2d of April, this event could not be carried out with great success owing to the bad weather, and out of 12 engagements only 2 were present at the start, these being a machine of the Gladiator (French) type, new model, with a 6 horse power water-cooled Aster motor, and an English machine, a 6 horse power dog-cart of the Marshall type. The weather was not favorable for the test, as a violent wind which blew during the day made the trip difficult. This was over the Kensington route, *via* Uxbridge, Beaconsfield, High Wycombe, and return. Both machines, however, made a good performance; the official record has not yet been made public. It is to be expected that the next contest, which takes place on the 2d of July, will be more successful.

A New Ruling on Patent Rights.

A ruling of Judge Kohlsatt in the United States Circuit Court is most important, as it makes valueless a patented device which has been used solely in a business not recognized by law. The plaintiff lost his case "in view of the lack of legal utility of the patented device." The case in point was a patented bogus coin detecter used in slot machines operated for gambling purposes. The decision by Judge Kohlsatt deprives the owner of the patent of standing in a court of equity to sue any man for alleged infringement on the device. The judge held that the patent in this case was not useful to the world in general and that the patent rights therefore could not be protected.

It is estimated that the cost of restoring the papal palace at Avignon, France, would be about $1,400,000.

A CHINESE TELEPHONE SYSTEM.

What is said to be the only Chinese telephone system in the world is in operation in the city of San Francisco. There are altogether about 18,000 Chinese citizens, of whom 1,500 are merchants. Of this number 270 are subscribers to the telephone.

These Chinese merchants were prompt to understand the saving of time and great convenience in the use of the instrument. Though looked upon, for a time, with some superstitious dread, familiarity has accustomed the people to its use and it has now become an indispensable concomitant of the regular office equipment. The central office heretofore has been too small to allow any increase of the subscribers, but the company has recently acquired a property and is fitting it up so as to accommodate any number. It is expected that with greater facilities twice as many instruments as are now in use will be installed.

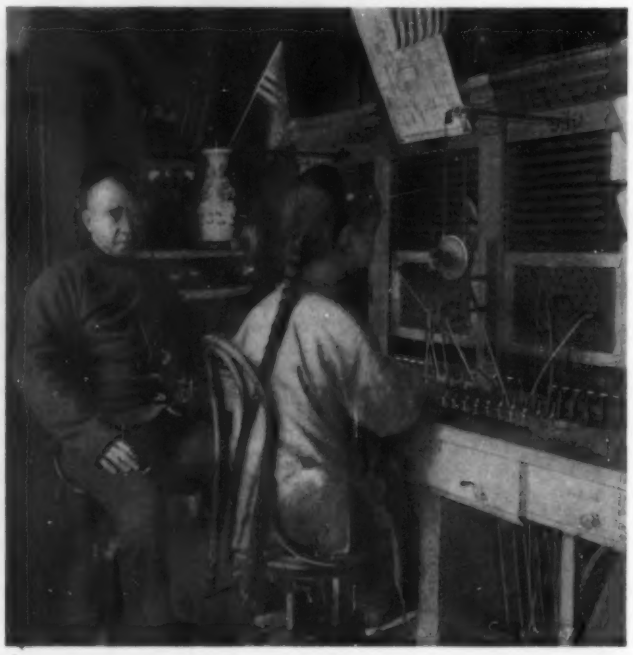
The system in Chinatown is entirely independent and is for the Chinese only. To communicate with outside subscribers a separate charge is made. A white merchant using the Chinatown system must also pay extra. The Chinese subscribers can and do use the long distance wires upon payment of the customary charges.

Altogether there are seven Chinamen employed in the office, a chief operator and three assistants, besides three messenger boys who are on duty day and night, the office being never closed. In respect to facility the Chinese telephone operators are quite equal to the whites.

It is said that the voice of the Chinaman is superior to all others in the distinctness with which it can be transmitted by wires. In calling subscribers the operator, instead of using numbers to designate each one, as customary among the whites, is compelled to call the names of the individual or firm that is wanted, a feat of memory of which only a Chinese operator is capable; and not only, it is said, is he equal to this, but also carries in his mind the probable haunt of the man required should he be unable to ring him up at his regular place of business.

The operators of the Chinatown system are in no relation to the metropolitan office. They are hired and paid by the Chinaman who controls it. The main company install the instruments and keep the wires in repair, allowing their Chinese agent a certain amount for each subscriber, the agent collecting the bills and securing new subscribers.

The San Francisco experiment has proved a successful one financially and is extremely popular among a people even as loath to accept new ideas as Chinamen are; and it is believed that one result of the local experiment will be the early introduction of the telephone throughout the whole Chinese Empire as soon as conditions of peace are assured.



A CHINESE TELEPHONE CENTRAL OFFICE IN SAN FRANCISCO.

THE NEW EDISON STORAGE BATTERY.

Probably no invention of recent years is of such vast electrical importance as the new accumulator which Thomas A. Edison has added to our store of electrical devices. Electricians were most agreeably astonished when Dr. A. Kennelly confirmed the rumors which had been rife many months, and gave the first full, clear description of the battery in a paper read before the American Institute of Electrical Engineers. The paper was published in last week's SUPPLEMENT and editorially discussed in these columns, so that our readers are now more or less familiar with the cell. Through the courtesy of Mr. Edison we were enabled to examine the battery, to prepare the drawings which accompany the present article, and to give some additional information which may prove of interest.

For the new cell an absence of deterioration is claimed which has never been characteristic of the most approved lead batteries. Its storage capacity per unit of mass is said to be unusually large. The time required for charging and discharging is exceedingly short. To these merits must be added cheapness in manufacture and durability. The negative pole or positive element and the positive pole or negative element are both similar in construction and respectively composed of iron and superoxide of nickel. When placed in their containing-cell the plates are separated by sheets of gutta percha. The electrolyte of this nickel-iron battery is a solution of potassium hydroxide. Each plate consists of a sheet of steel, 0.024 inch in thickness, perforated so as to form a grid with rectangular holes. In each opening of the grid a pocket or shallow box containing the active material is placed. In order to enable the electrolyte to reach the active material the boxes or pockets are perforated with many holes so as to form a kind of screen, which although it conceals the active material, permits the free entrance of the electrolyte.

The boxes or pockets consist of perforated crucible steel cut from a long strip 0.003 inch thick. To fit these boxes the active material is hydraulically compressed in the form of briquettes.

The positive briquettes are composed of a finely-divided compound of iron and a nearly equal volume of thin flakes of graphite. The negative briquettes are composed of a finely-divided compound of nickel and an equal quantity of fine flakes of graphite. In both plates the graphite does not enter into any of the chemical actions, but merely assists the conductivity of the briquettes. The iron and nickel compounds used are obtained by special chemical processes.

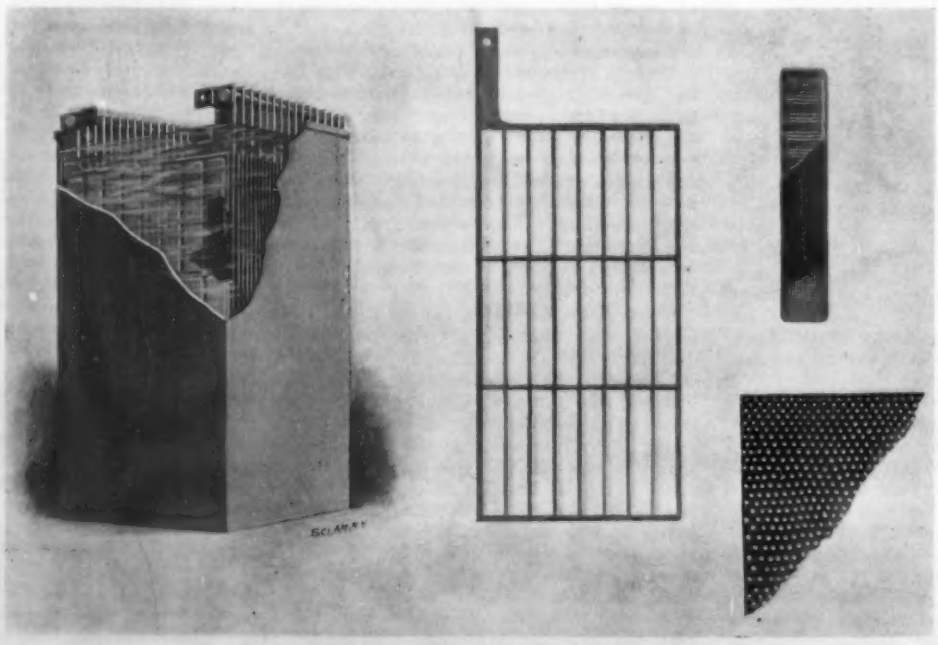
Each briquette when placed in its box is covered by a lid fitted over the box or pocket, so that the briquette is closely enveloped on all sides. Thus prepared, the boxes are placed in the openings or holes of their respective grids; and the assembled plates are thereupon subjected to a hydraulic pressure of some 100 tons in order to close the boxes and to force their metal sides over the adjacent sides of the recesses of the steel grid. A single, solid steel plate is thus produced. Both grids and boxes are nickel-plated in order to secure a good electrical connection between them. At any point the maximum grid thickness, after hydraulic pressure has been applied, is 0.024 inch, the pocket thickness being 0.1 inch. The cell in which the assembled plates are contained is composed of sheet steel containing the potash solution.

The charging current deoxidizes the iron compound to spongy metallic iron and conveys oxygen through the electrolyte to the nickel compound, forming a hyperoxide of nickel. In discharging, the current passes from the positive pole and through the external circuit to the negative pole and its attached iron or positive plate, and then through the solution to the superoxide plate, causing the oxygen to move back against the current and partially to reduce the nickel to superoxide, and to oxidize the spongy iron.

Since the potash solution theoretically serves as a conveyor for the oxygen, the amount of solution required is merely that which is sufficient to wet the negative material. The plates are hence packed as closely together as possible, because there will be less resistance and less weight.

The initial voltage of the discharge is 1.5 volts; the mean voltage of full discharge is approximately 1.1 volts. The storage capacity of the cell per unit of total mass is 14 watts per pound or 30.85 watt hours per kilo. The mean normal discharge of the power-weight per unit mass of total cell is 4 watts per pound, or 8.82 watts per kilo, corresponding with a normal discharge period of 3½ hours. At a high rate, however, a cell can be discharged in about one hour. Charging and discharging rates are the same. Overcharging or discharging affects only the electrical efficiency. No active material is ejected from the briquettes even under deliberate overcharging and discharging. Whatever gas is produced appears externally.

Changes of temperature seem to have no effect upon the cell. The electrolyte does not corrode any of the parts. The electromotive force being below that necessary to decompose water, no local action apparently occurs. Mr. Edison claims that a charged or discharged negative nickel plate can be removed from the working cell and dried in the air for a week, apparently without injury, and that when restored its charge seems practically undiminished. On the other hand, the positive iron plate if subjected to similar treatment soon loses its charge by the oxidation of the spongy iron, with a liberation of heat and an appreciable rise in temperature. When replaced, however, in the cell, the storage capacity of the plate is unaffected on recharge. According to Dr. Kennelly, Mr. Edison hopes to manufacture the new cell at a cost which will not exceed that of the lead battery.



THE EDISON STORAGE BATTERY—SHOWING ALSO GRID, POCKET FOR ACTIVE MATERIAL, AND PORTIONS OF GUTTA PERCHA PARTITION.

Zeper calls attention (Klin. Monats. für Augenheilk.) to the irritation of the conjunctiva, often amounting to conjunctivitis, and to the severe itching of the hands and face, which attack the workmen employed on the large bulb farms in separating dried hyacinth bulbs in August and September. The author attributes this to the presence of an acarus which he considers may work its way under the skin, but he also mentions the fact that masses of brittle crystals are found on the bulbs, the cells of which are well known to contain many raphides, and it is possible that those entering the skin may give rise to the irritation described.—Bost. Med. and Surg. Journ.

Freight can be carried on trolley cars within the city limits of Detroit.

THE NEW FLOATING DRYDOCK FOR THE UNITED STATES NAVY.

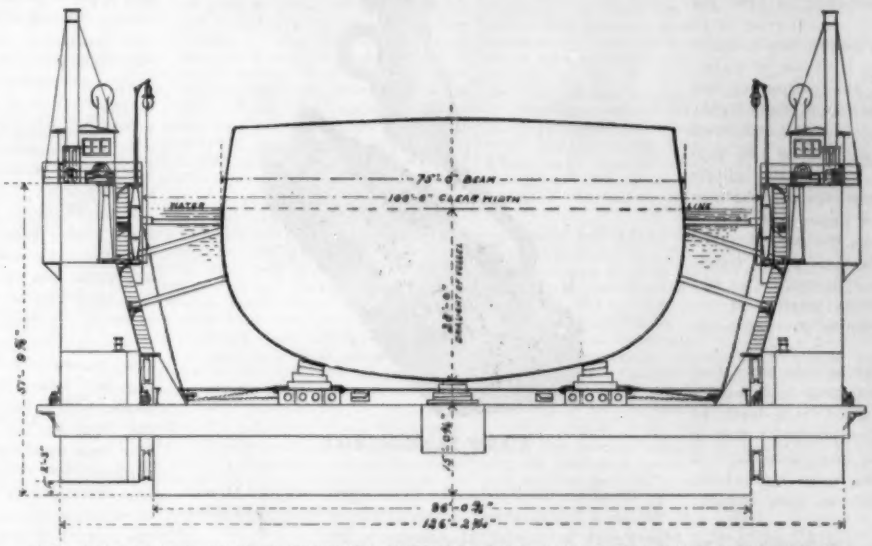
There is nearing completion at the establishment of the Maryland Steel Company, at Sparrow's Point, Md., a steel floating drydock which is intended to be located upon completion, at the United States Naval Reservation at Algiers, La., opposite New Orleans. Its length is 525 feet over blocks; it has an entrance of 100 feet in the clear between walls, and will have a maximum lifting power of 18,000 tons. It will be attached to two steel columns on shore by two steel lattice booms, articulated in all directions. The dock will, therefore, be free to rise and fall with the river, which is subject to frequent severe freshets, and sometimes rises to 20 feet above Gulf level. This connection will, at the same time, allow the dock to be swung inshore out of the worst of the current, which occasionally attains a speed as high as six miles an hour.

The general plans of the dock were made by Clark & Standfield, of London, England, who were the designers of many similar docks, the principal of which was the one constructed for the Spanish government, built by Swan & Hunter, of Wallsend-on-Tyne, England, and towed to Havana, Cuba. Another large dock of the kind is a commercial dock, which was also built in England, and was towed to Stettin, Germany. Several modifications and improvements were added to the first plans submitted, to meet the requirements of the Bureau of Yards and Docks, the details of these improvements being worked out by the engineering department of the Maryland Steel Company. Among other changes the structural strength throughout the pontoons was increased, giving the dock a maximum capacity of 18,000 tons when the deck or floor is awash, or of 15,000 tons with a freeboard of about 2 feet.

The specifications with these changes included call for a transverse strength sufficient for docking a battleship of 15,000 tons with the entire weight carried on the keel blocks. The specifications require that the time required for lifting a vessel shall be 3½ hours from the time the keel is centered on the blocks.

The mention of the question of the lifting power forms an opportune occasion for pointing out how comparatively little power is expended by a floating dock in lifting a vessel in a given time. When docking a vessel in a graving dock the whole of the contents less the volume of the ship has to be removed by pumping; therefore the smaller the ship in dock the greater the amount of water to be removed; moreover, when it has to be emptied, merely to prepare a berth for a ship, the whole amount has to be extracted. In a floating dock, on the contrary, the ship being supported by the buoyancy of the dock, the weight of water to be removed is only proportional to the weight of the ship, plus an amount representing the dock itself, while when the dock is lifted light, to prepare the berth, only its own weight has to be dealt with. The saving thus effected is therefore very great and is not only apparent in the reduced first cost of the pumping plant, but remains constant throughout the dock's career, in the form of a reduced coal bill.

The following are the general dimensions of the dock:



END VIEW OF THE ALGIERS FLOATING DRYDOCK, WITH A 15,000-TON BATTLESHIP SHOWN IN OUTLINE.

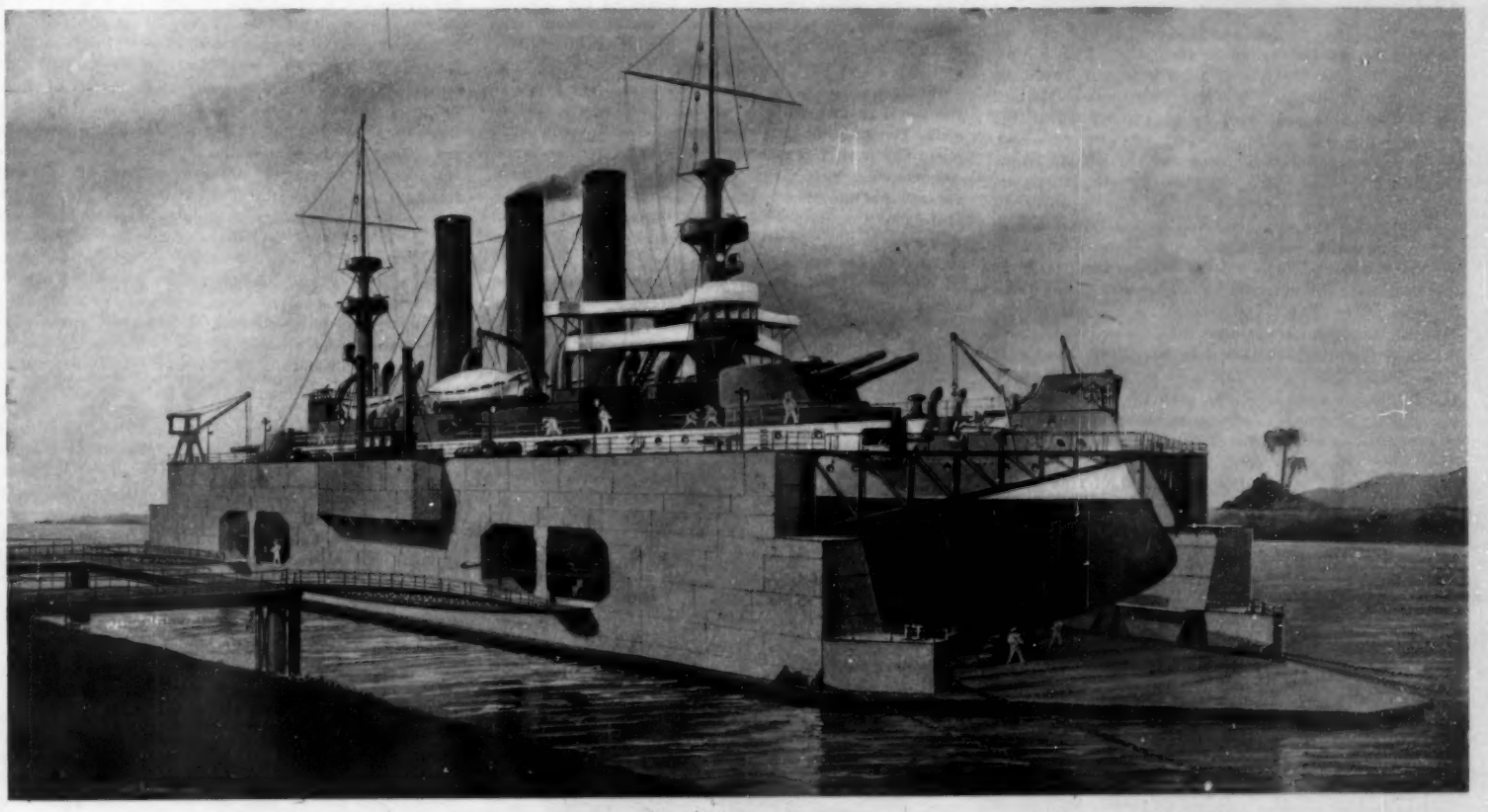
Length over all	525 feet.
Breadth over all	196 feet 2 7-16 inches.
Breadth between walls	100 feet.
Depth over sills	18 feet.
Depth of pontoons	17 feet 6 inches.
Maximum draft	49 feet 6 inches.
Number of pontoons	3
Length of middle pontoons	242 feet.
Length of end pontoon	141 feet 3-8 inches.
Length of walls	395 feet 5-8 inches.
Total weight of dock	6,865 tons.

The dock consists of five portions, and comprises three pontoons as the lifting portion of the dock, and two side walls, which latter, while affording a certain amount of lifting power, primarily serve to give the dock stability and to regulate its descent when the pontoons are submerged. The pontoons themselves are of different sizes and form. The center one is 242 feet long and rectangular in shape, but the rectangular length of two terminal pontoons is only about 80 feet, the remainder being finished off in the form of a blunt nose-point or bow. For a length of 55 feet these end pontoons are buoyant, and the remaining length forming the point proper is formed by a series of plate and lattice girders of strong construction. Each pontoon has three longitudinal bulkheads, the two outer ones being watertight while the middle one is designedly left with small openings.

This central longitudinal bulkhead is intercostal between the transverse bulkheads, and has two vertical plates, connecting to the first and second intermediate frames by angles. These longitudinal frames are placed 2 feet 6 inches apart and are of a girder design, each frame calculated to withstand a strain of from 40 to 65 tons load per foot. This construction is carried throughout the entire central portion of all the pontoons, and covers the area required for affording the necessary stability for carrying the heaviest battleships now built. Thwartship bulkheads are introduced every 10 feet, every fifth and sixth being watertight. The side walls are similarly constructed with five transverse bulkheads, and are provided with two gangway openings on each side. These walls are connected to the pontoons by steel castings and fish plates, and secured together by taper pins and bolts.

The operating plant consists of engines, boilers, and pumps, which are installed in the two walls, each being a separate and complete plant within itself. The main pumps are placed in the bottom of the walls, and are connected by vertical shafting and gearing, to engines which are of the compound type. They are furnished with automatic flywheel governors. A notable feature in the governing device of these engines is that the speeds of the pumps can be regulated with a variation of from 310 to 410 while the engine is in motion. The two side walls are also provided with flying gangways, which are placed at the bow end of the dock, and are hinged so as to swing together. They are provided with a platform and hand railing, which provides a means of passing from one side wall to the other. There are also on the inside of the side walls convenient ladders and stairways to reach the upper and intermediate deck from the deck of the pontoons. Each gangway deck and opening is provided with light swinging hand cranes for handling material from offshore connections or from lighters.

The actual mooring of the dock will be by four chair



THE NEW ALGIERS FLOATING DRYDOCK AS IT WOULD APPEAR WITH THE BATTLESHIP "MAINE" ON THE BLOCKS.

cables of the stud-link pattern, to which will be attached mushroom anchors, the handling of which is done by heavy capstans connected to powerful winches; the cables are provided with coil-spring buffers where they make fast to the dock. There are also provided auxiliary winches, fairleads and all the necessary appliances for handling the lines for docking a vessel. The operating valve houses are located on the top deck of each side wall, from which position the entire manipulation in docking a vessel is conducted. Four mechanical side shores, two in each wall, are also operated from these top decks, so that a vessel can be easily and directly centered over the keel blocks.

An important feature of the dock is that any portion of it can be made accessible for repairs or inspection. To reach the bottom of one of the walls, say the port one, it is only necessary to heel the dock to starboard.

In the case of the pontoons, the middle one is made large enough to raise those at the ends out of water. Suppose it is desired to get at the bottom of the middle pontoon: the dock is allowed to float light; men then knock on the tapered pins of the two rows of fishplates which secure this pontoon to the side walls; then the dock is allowed to sink, the middle pontoon floating free, until the lower row of fishplates on the pontoons is level with the upper row on the walls; the pins are then driven in, the dock pumped out and the middle pontoon is lifted clear of the water. To unlock, the reverse course is followed. The end pontoons are similarly treated. The interior of the walls and pontoons is easily accessible through numerous manholes.

Should a disabled ship draw one or two more feet than the capacity of the dock permits, the dock master would not hesitate to sink the dock the extra depth, as the walls have a minimum freeboard of 4 feet 9 inches. Also, should a ship, from any cause, have a list, the dock could be given the same list within limits, the ship taken in, and the two then brought to an even keel.

It is a curious coincidence that the launch of two identical warships built for the United States navy should be taking place within a few weeks' interval at two establishments so widely separated as that of the Union Iron Works, San Francisco, and that of William Cramp & Sons, at Philadelphia. The "Ohio," recently launched in San Francisco by the President of the United States, is a sister ship to the "Maine," whose launch is scheduled to take place about the time that this issue will be in the hands of our readers. Another vessel which is being built from the same plans, and will be named "Missouri," will shortly be launched at Newport News, Va. As the "Maine" and her sisters are the largest vessels in the United States Navy, our artist has shown her docked in the new Algiers drydock; and it will be noticed that, large as this vessel is, she does not by any means exhaust the capacity of the dock. The principal dimensions of the "Maine" are, total length 388 feet, beam 72 feet 2½ inches, mean draft 23 feet 6 inches, displacement at mean draft 12,300 tons, full load displacement being 13,500 tons, or 4,500 tons less than the maximum lifting capacity of the dock. The contract speed is 18 knots. The "Maine" is surrounded at the waterline by a coffer dam filled with water-excluding material in the shape of a preparation of cellulose. The belt of side armor extends from 3 feet 6 inches above to 4 feet below the waterline. Amidships it is 11 inches in thickness at its upper edge and 7½ inches at its lower edge. A complete casemate armor belt, 6 inches in thickness, extends from the upper edge of the side belt to the upper deck. The vessel is armed with four 12-inch, 40-caliber guns, sixteen 6-inch, 50-caliber, rapid-fire guns, and six 3-inch 50-caliber rapid-fire guns; besides eight 6-pounders, six 1-pounders, two 2-inch field guns and two Colts. The 12-inch guns are carried in pairs in turrets protected with 11 to 12 inches of Krupp armor. The armored deck varies in thickness from 2¾ inches on the flat to 3 and 4 inches on the slopes. The supply of ammunition is plentiful—a most important feature in ships armored so largely with rapid-fire guns. The "Maine" carries 240 rounds for the 12-inch gun, over 3,000 for the 5-inch, 9,000 rounds for the 6-pounders and 4,000 rounds for the 1-pounders. The motive power is of the very latest type, steam being supplied by twenty-four Niclausse boilers with a total heating surface of 58,104 square feet. When the battleship is in commission, she will carry thirty-five officers and 511 men.

It is a fact not generally known that nearly all of the common lizards change color like the chameleon, but the change is less rapid. The ordinary fence lizard will be black after remaining upon black soil for about half a minute, but upon an old-fashioned rail fence the animal soon assumes the motley gray hue of a weather-worn rail. Upon a green leaf the same lizard will take on a decidedly greenish tint. The change of color, both in the chameleon and the common lizards, appears to be nature's subterfuge for the protection of the animal.

A SIMPLE BRICK-CARRYING DEVICE.

Our illustration pictures a clamp for carrying brick, which comprises essentially a turnbuckle engaged by oppositely-threaded shafts. Of these shafts one terminates in a grip and the other in a clevis. A bar is pivoted in the clevis and is provided at one end with a grip and at the other end with a handle and a loop.

The bricks are arranged side by side. By means of the oppositely-threaded shafts, the device is adjusted to pick up a certain number of bricks. The handle-bar is lowered, and the grips are slipped over the sides of the two end bricks. When the device

A NEW BRICK CARRIER.

is lifted by the handle the grips firmly clutch the end bricks. The inventor of this brick-carrying implement is Frank E. Sproat, of Allegheny, Pa.

A SELF-MEASURING PUMP FOR LIQUIDS.

A pump which automatically measures the amount of liquid which it raises from a vessel is a novelty recently patented by Marshall Comincavish, a resident of the town of Fort Wayne, Ind.

Integral with the handle of the pump is a segment composed of two parallel parts straddling the piston-rod. The segment parts are provided with registering openings through which a pin may be passed, designed to come into contact with the piston-rod when the handle is raised and then limit the stroke of the piston. The bottom of the cylinder is perforated to receive a suction-pipe leading to the vessel containing the liquid. A valve in the suction-pipe is opened on the up stroke of the piston and closed on the down stroke. The liquid pumped in the cylinder is forced up into a goose-neck pipe connected with the cylinder and provided with a valve opened on the down stroke of the pump.

A SELF-MEASURING PUMP FOR LIQUIDS.

The short leg of the goose-neck pipe is composed in part of a glass-section to which a rubber tube is attached.

In operation the handle is raised until the pin strikes the piston-rod, thus limiting the stroke. On the upward movement of the piston liquid is drawn up into the cylinder. On the downward movement of the piston the liquid is forced up into and out of the goose-neck pipe, the valve in the suction-pipe being closed and that in the goose-neck opened.

The glass is used for sampling the liquid. This may be easily done by running a small quantity of the liquid into the rubber tube and squeezing the ends to retain the liquid. By detaching the tube the liquid may be tasted.

Electrolytic Apparatus for Hypochlorites.

In a recent article upon the electrolytic preparation of chlorates and hypochlorites on an industrial scale, M. Brochet describes several of the most recent forms of apparatus for the production of hypochlorites, these having a special value in the industries as being used to replace chlorine and chloride of lime for bleaching purposes. In the Hermite system, the electrolytic apparatus has anodes formed of platinum gauze held in ebonite frames. Between the anodes are placed the cathodes formed of zinc disks mounted on a shaft by which they are given a rotary movement; there are two such revolving cathodes for each pair of anodes. The shafts are mounted upon the top of the electrolytic tank, which serves equally as cathode. The solution used contains 50 parts of common salt and 5 parts of chloride of magnesium for 1,000 parts water. The apparatus forms mainly hypochlorous acid and magnesia, the latter being deposited upon the cathodes, from which it is removed by scrapers. The industrial apparatus of this type takes about 1,000 amperes at 5 to 6 volts, representing 8 or 9 horse power. It produces in 24 hours a solution which has a bleaching power equal to 275 pounds of chloride of lime, or 88 pounds of active chlorine. An apparatus of the Corbin type is used in a large paper works at Lancey (France). The electrodes are formed of platinum plates fixed in ebonite frames; these frames fit into the tank and divide it into compartments. The apparatus contains thirteen such plates and absorbs 120 volts and 150 amperes, or about 25 horse power. A dilute solution of salt, 2½ per cent, is used. The liquid circulates continuously; it comes out of a reservoir, passes into the electrolyzer, then into the bleaching vat, where it comes in contact with the wood-paste, which has been already partially bleached by the Mitscherlich process with bisulphite of lime. The vats measure 6 by 15 feet and 3 feet high; they contain 1,700 pounds of paste, which is made to circulate continuously by an agitator. The liquid is caused to circulate by means of a drum which takes it from the vat in a constant manner and sends it into a double-bottomed tank, from which it is raised to the first reservoir by a centrifugal pump. When the paste has remained long enough in contact, it is sent into the double-bottomed tank where it is drained. As it takes about 20 parts by weight of chloride of lime to bleach 100 parts of wood-paste, it results that each apparatus bleaching in 24 hours 1,700 pounds of paste, produces the equivalent of 250 pounds of chloride of lime, or 110 pounds of chlorine. The Kellner apparatus, constructed by Siemens & Halske, is used to a considerable extent in Germany. It consists essentially of an earthenware tank carrying on opposite sides a series of grooves in which slide a series of perforated glass plates, thus dividing the tank into twenty compartments of one-inch width. These glass plates serve as supports for the electrodes, which are formed of platinum gauze fixed on each side of the glass plate, and united by wires passing through the holes. The electrolyte is a solution of salt of 10 per cent strength; it enters at the bottom of the tank and comes out by overflow holes placed betwen the plates The speed of circulation is regulated so that the liquid coming from the tank contains 0.05 per cent of chlorine; it then descends to a lower chamber containing a spiral of hardened lead pipe in which circulates a current of cold water. A centrifugal pump, also of lead, raises the liquid to the tank, and it thus circulates in a continuous manner until its strength reaches 0.7 to 1.0 per cent of chlorine. An apparatus of this type consumes 112 volts and 114 amperes, or 19 horse power, and gives in three hours 90 gallons of a solution containing 0.85 per cent of chlorine, representing 1 pounds of active chlorine.

The Current Supplement.

The current SUPPLEMENT, No. 1328, is begun by an article on M. Berthelot, accompanied by an engraving, showing the great chemist in his laboratory. "The Hospitals of Japan" is a very instructive article. "Low Grade Gold Mining and Milling" is accompanied by illustrative diagrams. "Electrically Operated Radial Drills" shows several new types of machine tools. "Animal Change and Environment" is by Prof. Thomas H. Montgomery. "Animals that Clothe Themselves" is an interesting entomological article. "Syntonic Wireless Telegraphy" is by Guglielmo Marconi. "Germany's Machinery Trade in 1900" gives full statistics.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

DRAFT-EQUALIZER.—EDWARD E. MAXON, Abbott, Neb. The draft-equalizer comprises a main beam on which three whiffletree-carrying levers are independently mounted, a connection extending from each end of the middle lever respectively to the ends of the remaining levers. By these means the horses are hitched to a plow or harvester in such a way that all may work on unplowed ground, when a plow is used, and on stubble ground when a harvester is used.

DIVIDER FOR MOWING OR REAPING MACHINES.—JOHN M. CLARK, Rathbone, Mo. The invention provides improvements in devices for dividing the grass or grain at the end of a cutter-bar; and by its means short, long-standing, or fallen grass or grain is effectually divided without manually adjusting the device for varying heights.

Engineering Improvements.

VALVE.—WILLIAM F. MULLANEY, Marshall, Minn. This invention relates to a valve which is so constructed that it can be operated either by pressure applied directly thereto by sliding its stem, or by pressure applied by the action of a screw formed on the stem. In the former case the valve may be operated quickly, and in the latter case great force may be brought to bear on the valve.

MEANS FOR GOVERNING SUPPLY OF STEAM UNDER PRESSURE.—CICERO M. HOBBY, Iowa City, Iowa. The object of the invention is to provide a simple device in which the supply of steam or other fluid is cut off automatically as soon as a predetermined pressure is reached. The invention is applicable to engines, pumps and other apparatus, but is particularly suitable for the automatic supply and cut-off of steam in pumping-engines, in engines without gearing to produce circular or reciprocating motion, and for use where the boiler-pressure or live pressure is variable and skilled or regular attendance impossible.

Jars and Bottles.

TESTING-BOTTLE.—CONSTANTINE WAGNER, Manhattan, New York city. The inventor has devised a bottle for testing milk and other liquids, which bottle is arranged to permit one conveniently to make a test, and readily and accurately to read off the amount of fat without the use of dividers or like measuring tools. The column of fat is brought down in the graduated tube until the bottom is at zero. The height of the column of fat can then be easily read off without calculation or the use of a measuring tool.

NON-REFILLABLE BOTTLES.—LUTHER A. MCCORD and JOHN D. ADAMS, Laurens, S. C. The valve-seat in the bottle-neck is normally closed by a ball-valve held to the seat by a weighted pendulous portion. A guard is provided which serves to deflect a wire inserted through the neck for the purpose of unseating the valve. An attempt to refill the bottle by means of a vacuum-pump is frustrated, for the reason that the ball-valve floats on the rising liquid and closes the valve-opening.

JAR-CLOSURE.—JOHN SCHIES, Anderson, Ind. This improved jar-closure is of simple construction, can be easily applied to the jar, and easily removed. To remove the closure it is necessary merely to take an ordinary table-knife and press back small points or teeth which hold the closure to the jar top. This releasing of the points or teeth is facilitated by their form.

JAR-CLOSURE.—JOHN SCHIES, Anderson, Ind. The neck of the jar is provided on its outer side with a downwardly-facing shoulder. On this neck a cap fits. To secure the cap, a continuous unbroken ring is employed, having at its upper edge an inwardly-projecting flange overlying the outer edge of the cap and extending inwardly beyond the inner line of the external downwardly-facing shoulder. The body of the ring is fitted snugly around the neck of the jar and has at its lower edge, portions bent beneath the shoulder of the jar-neck and arranged to be bent outwardly to release the closure.

Mechanical Devices.

METAL-BENDING MACHINE.—CHARLES DECRETTE, Manhattan, New York city. The machine is designed to bend metal bars at a sharp angle at one operation with only one heating of the metal. Thus, much time and consequently much expense is saved, as compared with the bending-machines in which several heatings of the metal are required.

SAFETY GAS-LOCK.—CHARLES H. LEWEY, Chicago, Ill. The inventor has devised an improved safety gas-lock for the shut-off cock in a gas or other supply pipe. The lock is controlled by the key of the main entrance door to the factory, store, or other building in which the lock is located, so that the shut-off cock cannot be reached and opened until the door is unlocked; and the door cannot be locked until the shut-off cock is closed, for only then the key for closing the door can be removed from the gas-lock.

DUMPING-WAGON.—CHARLES CARROLL, General Delivery, Chicago, Ill. Mr. Carroll has provided a simple construction in which the body of the wagon is so hinged that it can be readily tilted into dumping position. A tilting rear-truck is secured to the body and connected with the forward truck by a hinged joint and by bars which extend rearwardly from the forward truck, means being provided whereby the hinge connection of the body and the axle of the rear truck may be caused to depart in order to dump the wagon.

SAWMILL-CARRIAGE.—BENJAMIN E. SERGEANT, Greensboro, N. C. This invention is an improvement in sawmill-carriages designed to hold the projecting ends of the rack-bar in a positive and certain engagement with the subjacent pinion by which it is driven. A more convenient, stronger, and practical construction of sectional log beam is also provided for the carriage.

ORE-PULVERIZER.—ALBERT C. CALKINS, Los Angeles, Cal. The patent describes a convenient and effective device for further reducing or pulverizing crushed ore before separating the precious metals which it contains. The machine is designed for the use of assayers and chemists. The device comprises a concave bed and an oscillating shoe having in its middle an opening leading to the space between the shoe and bed. The middle of the upper surface of the shoe is lower than its outer edges, and its outer edges are sharp. This construction permits the coarse particles to tumble over the sharp angle in returning to the middle of the shoe.

GYRATORY MULLER.—ALBERT C. CALKINS, Los Angeles, Cal. The distinguishing features of novelty in this invention are a hinged ball-shaped frame in combination with open grappling hooks on a rotating shaft, by which the parts may be quickly opened and separated. By reason of this construction the machine can be rapidly cleaned after finishing one laboratory sample, and before grinding another. The only adjustment necessary is the turning-back of the ball, the bifurcated and hook-shaped crank-arm being thereby separated from the pins of the box.

TOY PISTOL.—EARL T. ADAMS and JOHN E. SIMPSON, Portsmouth, Ohio. The pistol has a moving tape or strip with spaced percussion caps thereon. The construction is simple and durable. A large number of caps can be exploded in rapid succession without the slightest danger.

WASHING-MACHINE.—HENRY F. and ROBERT H. STAGGS, McKinney, Texas. These inventors have devised an improved washing-machine arranged for use on any kind of tub and adapted to insure a perfect, uniform washing of all the clothes in the tub by the use of yieldingly-mounted pounders which intermittently change their positions relatively to the clothes under treatment.

CENTRIFUGAL CLARIFIER.—FRANK H. RICHARDSON, Pueblo, Colo. The object of the invention is to provide a machine which centrifugally separates impurities from water or other liquids. The clarifier comprises a rotary cylinder around the inner side of which sediment-chambers are arranged. Valves control communication between the sediment-chambers and the interior of the cylinder. A vertically movable part produces vertical movements in the valve. The movable part is moved by gear-wheels driven by the rotary motion of the clarifier.

REVOLVING TRUCK FOR FLAGPOLES.—SYLVESTER S. MCGRATH and JOHN J. LAWLOR, Manhattan, New York city. The invention provides a truck capable of revolving upon a flagpole, on which a lightning-rod is used. The revolving truck serves to prevent the halyards from becoming entangled, and also serves to protect the halyards where they pass over bearings in the truck.

TELLURIAN.—ADGAR A. HOYLMAN, Organcave, W. Va. The chief object is to produce a simple apparatus to enable a teacher to explain the fundamental facts of astronomy, such as the inclination of the earth's axis to its orbit; the rotation of the earth upon its axis; the alternation of day and night for different longitudes and latitudes for different seasons of the year; the revolution of the earth around the sun; the change of the seasons; the revolution of the moon around the earth, and its relation in time to the revolution of the earth around the sun; the conditions under which eclipses of the sun and moon occur, and other phenomena resulting from the relative motion of the sun, earth, and moon.

ROLLER-MILL FOR GRINDING AND CRUSHING.—JOHANNES C. WEGERIF, Leigh-on-Sea, Essex, England. With the ordinary hyperboloidal rolls, the obliquity of the roll-axes, necessitates the placing of one or both axes out of the horizontal plane, in consequence whereof an undue proportion of the pressure is borne by the bearing at the lower end of the roll, thereby very seriously affecting the efficiency of such rolls. The present invention obviates this evil, the axes of both rolls being perfectly horizontal.

SCREW-DRIVER.—GARY L. WOODRUFF, Albany, N. Y. The inventor has devised an improvement in screw-drivers in which the handle and shank are adapted for rotation when pressure is applied, so that a screw engaged by the bit is driven into the material. The novel features of the invention are to be found in a peculiar construction of bit which is so formed at its free end that it can be used for boring holes. Furthermore, a bit designed for drilling metal can be substituted for the wood-boring bit, thus increasing the range of utility of the instrument.

HALF-TONE NEGATIVE.—THOMAS S. FOX, Brooklyn, New York city. To avoid much of the hand or rule work which in photoengraving is slow and expensive Mr. Fox has devised a novel method of making a negative. The portions not to be reinforced are stopped out with gum; and the portion to be reinforced is inked. Thereupon the stopped-out portion is washed. Finally an opaque substance is applied to the ink to render the ink of the impression opaque. Variegated but extremely strong effects are produced in the final prints.

CABLE-GRIP.—CHARLES NOBLE, Sisson, Cal. The invention [illegible] improvements in cable-grips employed in [illegible] The grip has but few parts and is not liable to get out of order. The construction is such that the simple act of hooking the device over a cable after the draw-dogs are fixed in a log causes it to grip the cable and remain fixed thereon until the draw-dogs are removed.

ACETYLENE-GAS APPARATUS.—OLIVER H. HAMPTON, Williamsburg, Ind. The gas-machine which has been devised by Mr. Hampton automatically generates gas in accordance with the amount consumed. The danger of the generator's bursting by overpressure is entirely obviated. Means are provided for automatically obtaining a uniform level in the generator. The carbid-holder is entirely submerged in an ample quantity of water, and therefore the gas is kept cool. Generation begins at the bottom and the gas is made to pass over the unused carbid which absorbs the moisture from the gas.

BORING-MACHINE.—SUMPTER L. HARWOOD, Faunsdale, Ala. The machine is a well-boring machine in which water is forced to the revolving drilling tool to assist in loosening the ground and to cause the loose material to flow up in the drill-hole. The rate of cutting can be regulated according to the nature of the soil without subjecting the drill to the weight of the pipe-line. The pipe-line and drilling-tool are prevented from dropping into a bed of quicksand, if such be encountered.

TOOL.—DANTON O. BRUNNER, Somerset, Ohio. The tool, as constructed in accordance with the provisions of this patent, is compact and may be used for many purposes. It is specially serviceable in a stable, or as an implement to be carried in a vehicle. A nut-wrench, a pincers, and an eyelet-punch are included in the tool.

STAMP-FIXING MACHINE.—ALBERT S. HEINTZ, 213 Thirteenth Street, Portland, Ore. The inventor has devised an automatic and perfectly operating device through the agency of which a stamp may be cut from a sheet or strip, moistened and secured upon an envelop, document, or package, by the movement of a single rod or lever.

Railway Contrivances.

JOURNAL-BEARING.—ELWOOD E. BENNER, Sargent, Neb. Mr. Benner has devised an improvement in the brasses employed in car-journal bearings. The invention provides means for lubricating the journal by the use of water, thus economizing in the cost of lubricant and at the same time cooling the journal by means of the lubricating agent.

JOURNAL-OILER.—FRED E. PARSONS, Marshall, Minn. This invention relates to a simple device designed to be placed in a journal-box to hold the absorbent packing yieldingly against the journal, and by the use of which a less amount of packing is required than is ordinarily necessary.

Miscellaneous.

CLASP.—ARTHUR N. LUNDBURG, Wayne, Neb. The clasp is adapted especially for application to suspenders to take the place of suspender-buttons and the usual loops which are employed to connect the suspenders with the buttons.

BED.—WILLIAM D. OLNEY, Stillwater, Minn. The bed is mounted on rollers so that it can be readily moved from place to place. The construction is such that the bed can be moved into engagement with a cabinet and folded out of operative position. By this construction all the merits of the folding-bed are retained without the danger of an accidental collapse.

DRINKING-GLASS HOLDER.—RUDOLPH METZ, Atlantic City, N. J. The drinking-glass holder comprises two straps adapted removably to embrace the glass. Each strap comprises a retractile spring which serves to hold the straps around the glass. A handle extends between and is connected with the straps. The holder is merely slipped over the glass, the spring serving to prevent the straps from slipping.

KEYBOARDS FOR TYPEWRITERS.—JUAN B. VIDAL, Havana, Cuba. The invention provides an improved arrangement of keys by which the attainment of great speed in writing is facilitated, and which enables an operator to write as much by touch as by sight, thus rendering the work easier. The keys are arranged in two sections, one for the right hand and one for the left, and in each section the keys are disposed in groups, one group for each finger.

HAMMOCK.—LOUIS A. WRIGHT, Aspen, Wyo. The hammock is made of leather strips and a series of loops extending longitudinally. The loops in a series are linked together, each loop embracing a step between the link ends of the loop. Thus constructed a hammock forms a very durable supporting surface and can be very easily folded.

TIMBER-HOOK.—GEORGE H. HUTCHINOS and PATRICK L. LACHAPELLE, Hoquiam, Wash. The novel features of the invention are to be found in the arrangement of connecting-straps in pairs extending side by side; in lapping the joint plate and the hook bars on opposite sides; and in providing the drag device with side bars which extend on opposite sides of the hook-bars and of the joint-plate. The inventors are thus able to avoid all twisting of the joints and to brace the parts of the hook in the desired positions.

PUMP-CAP.—AUGUST GUSTAFSON, Cherokee, Iowa. The cap or cover for the pump-barrel is provided with an opening for the passage of the pump-rod. A yoke is located on the outer side of the cover and spaced therefrom. Between the cover and the yoke at opposite sides of the opening are separate blocks adjustable toward and from the opening. The yoke and cover can be pressed toward the pump-barrel. The pump-cap thus constructed can be conveniently applied to a new or old hand-pump or force-pump.

ELECTRIC-FIXTURE BASE.—JAMES W. SMITH, Brooklyn, New York city. The fixture-base is intended for use on flat surfaces and can be fastened closely to a wall without using a number of intermediate unsightly parts. In this respect the fixture differs from the ordinary insulating device which is designed for attachment to gas-pipes, and which when secured to flat surfaces requires the interposition of a separate base.

MEANS FOR SWAGING METAL DENTAL PLATES.—NORRIS C. LEONARD, McMinnville, Tenn. The purpose of the invention is to furnish devices which provide simple and effective means for swaging metal dental plates directly on a plaster model. Thus, a more accurately fitting plate is produced than is ordinarily possible, and thus the necessity of making counter-dies is obviated. The invention saves much time and labor and prevents the plate from being scarred.

FIRE-HOSE NOZZLE.—THOMAS F. BURKE, Engine Company 52, Van Cortland Avenue, Riverdale, New York city. The fire-nozzle is designed to supply both air and water. Air is first pumped by the fire-engine instead of water in order to drive away the heavy smoke and to enable a fireman to locate the blaze without danger of being suffocated. Then the water is turned on and the fire extinguished. One of the novel features of the invention is a distributer which discharges water in the shape of a circle 125 feet in diameter. The fine stream of water thus obtained is hurled to a distance equal to that of a large stream, in which respect the nozzle differs from ordinary hose nozzles. This device has been very successfully tried and will be adopted by the New York Fire Department.

SCABBARD.—GEORGE R. SIMMONS, French Gulch, Cal. The scabbard is a bowie or hunting knife scabbard. The sheath or scabbard commonly provided for the blade of a bowie knife is not adapted to receive the cross-guard plate of the handle. It thus often happens that the plate is caught by high grass or cane and the knife pulled out. The improved scabbard obviates this difficulty.

FRAME-LATCH FOR BAGS, PURSES, ETC.—LOUIS B. PRAHAR, Brooklyn, New York city. The invention is an improvement upon a similar device already patented by Mr. Prahar. The novel feature of construction is a locking device which is adaptable to a pocket-book frame. The members of a frame can be unfastened either by rocking the locking device in one or the other direction or by drawing the locking device outward. When relieved from tension the locking device is always in position to latch the members of the frame.

MUSICAL INSTRUMENT.—HENRY C. MARX, Linn, Kans. The instrument is of the zither type, and is provided with keys for striking certain of the strings to produce chords, while the melody is played on a certain number of open strings or on certain of the strings with which the keys are designed to engage.

CURTAIN-HANGER.—JOHN L. F. C. KOBER, Cincinnati, Ohio. Means are provided for hanging curtains securely and artistically without the use of cumbersome and unsightly devices such as the usual curtain poles and rings. The curtain is hung by means which are entirely obscured, thus making it possible to display ornamentation.

TRUSS.—HENRY H. GERHARDT, Nashville, Tenn. The truss is so constructed that the pads or supports can be adjusted vertically and laterally to and from each other, and also adjusted to and from the person in order to increase or decrease their pressure. Each pad is also independently adjustable. The body-belt by which the pads are supported coacts with an auxiliary belt adapted to hold the body-belt in position and prevent the adjustment of the pads from being disturbed.

Designs.

DISPLAY CARD.—HENRY HEININGER, Orange, N. J., and WILLIAM UNGER, Manhattan, New York city. The display card is a bachelor's display card of an amusing character.

HOOK.—AUGUSTUS BROCKELBANK, Ossining, N. Y. The hook is to be used in connection with an eye for garments and is formed in a novel manner to enable the eye to be readily gripped and readily released.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Machine chain of all kinds. A. H. Bliss & Co. North Attleboro, Mass.

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Sheet Metal Stamping: difficult forms a specialty. The Crosby Company, Buffalo, N. Y.

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Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

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WANTED—Partner to furnish money for patenting a useful invention. For particulars address A. Paul, 630 Third Ave., Brooklyn.

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Wanted an expert Asphalt Mining Engineer to accompany me to Mexico at once. Address C. & Y., 31 Nassau Street, N. Y.

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Inquiry No. 844.—For parties to manufacture a gas lamp made of sheet brass and galvanized iron.

Inquiry No. 845.—For dealers in an attachment to be applied to gas pipe to cause the gas to flow through a tank of gasoline.

Inquiry No. 846.—For cider-making machinery.

Inquiry No. 847.—For machinery for manipulating coffee, maize, sugar, etc.

Inquiry No. 848.—For apparatus to compress sulphurous acid gas commercially.

Inquiry No. 849.—For makers of hard gray felt.

Inquiry No. 850.—For punching machinery for punching out mittens by means of dies.

Inquiry No. 851.—For manufacturers of patent ladies' glove fasteners.

Inquiry No. 852.—For manufacturers of fancy leather.

Inquiry No. 853.—For manufacturers of refrigerating plants.

Inquiry No. 854.—For manufacturers of apparatus for burning petroleum in furnaces.

Inquiry No. 855.—For improved woodworking machinery.

Inquiry No. 856.—For manufacturers of small stationary boilers and engines.

Inquiry No. 857.—For manufacturers of tracing wheels.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(8206) The K. Pub. Co. ask: How can copper be mixed in Babbitt, if it can be done? A. Good Babbitt metal contains copper. If you wish to add more, use copper filings, put in the bottom of the crucible, Babbitt on top, and cover with common soda; melt and stir.

(8207) F. R. M. asks: Can ice on a pond have a temperature below 0° C.? Why or why not? A. Ice is a very poor conductor of heat. The water under the ice in contact with it is at a temperature of 0° C. at all times. Below that the water rises from 0° C. to 4° C. If the ice is sufficiently thick we see no reason to doubt that its upper surface may be even below 0° C. when the lower surface is at 0° C. 2. If the pond is frozen clear to the bottom, can the temperature of the ice go below 0° C.? A. Ice has a specific heat about one-half that of water; that is, it will cool twice as readily. After ice is formed it behaves like any other solid; it may be cooled far below its point of freezing, just as iron or lead can. A piece of ice lying in the air at 40° below zero comes to be itself 40° below zero, of course. We very often meet the idea that ice must remain at the freezing point. Why should it? 3. In the lower illustration on page 49, SCIENTIFIC AMERICAN, January 26, 1901, why is the load on the forward large driving wheel placed on the same side as the coupling rod? Should it not be at the other end of the diameter? A. The counterbalance shown on the forward driving wheel is opposite to the driving crank on the inside, not shown. It is very light, and with the outside connecting rod counterbalances the inside driving crank and rod.

(8208) H. C. A. writes: In query 8068 F. L. asks concerning Avogadro's law and water. Is your reply correct, considered in the light of modern chemistry? No allowance has been made for the degree of electrolytic dissociation of the H_2O molecules—$HLHO + H_2O$ is not apparently considered, and you are probably aware that Avogadro's law never quite answered until the electrolytic dissociation factor corrected the error. A. The authority for the answer to which exception is taken was Remsen's "Chemistry," latest edition. Is there any better? We might cite also Lupke's "Elements of Electro-Chemistry," Walker's "Introduction to Physical Chemistry," Speyer's "Text-Book of Physical Chemistry" to the same purport. Nor does it seem that the discovery of electrolytic dissociation can have any bearing on the truth or falsity of Avogadro's hypothesis, since electrolytic dissociation was active and a fact when Avogardro discovered the statement which bears his name. Avogadro's law was inclusive of all the facts of the case, known or unknown.

(8209) A. D. asks: Can I convert a spark coil into an induction coil, and how? A. It is not advisable to try to convert a spark coil into an induction coil. You would better start new and make an induction coil. Our SUPPLEMENT No. 1124, price ten cents, describes one which gives a spark 6 inches long. Bonney's "Induction Coils," price $1, by mail, contains plans for coils of a variety of sizes.

(8210) L. L. C. asks for a solder for aluminium. A. A good solder for aluminium is an alloy of 50 parts cadmium, 20 parts zinc, 30 parts tin. Another: 45 parts tin, 10 parts aluminium. In alloys of cadmium and aluminium 15 to 30 per cent of cadmium has been used for solder.

(8211) J. H. L. writes: A friend and myself are interested in the telephone and we would like to know what the Ader receiver and relay are, or are there any other apparatus by Ader? On these points we would like to have more information. Where can we get it? A. The Ader transmitter is a multiple transmitter, and the Ader receiver is a bipolar receiver. They are described in Miller's "American Telephone Practice," price $3 by mail, a book which should be in the hands of every student of the telephone.

(8212) M. F. K. asks: 1. Can you give a rule for figuring the way to build transformers, i.e., the number of turns, size of wire, etc., for any current? A. The designing of a transformer for any current cannot be covered by a single rule. There are other factors to be taken into account besides the ordinary resistance. We can recommend Kapp's "Transformers for Single and Polyphase Currents," price $1.75 by mail. 2. When resistance is put in a circuit does it reduce the amperage proportionately as the voltage? A. Resistance added to the circuit of a direct current reduces the amperes, but not proportionately to the added resistance. The current follows Ohm's Law, $C = E/R$. R is the sum of all the resistances of any sort in a circuit. The added resistance is only a part of the total resistance, and the amperes should be figured from the resistances and the volts. The total voltage has no dependence upon the resistance. The rate of drop of voltage between two points on a circuit does vary as the resistance between those points. In alternating current circuits another factor is added to the problem, namely, the self-induction of the circuit. So that the apparent resistance of an alternating circuit is greater than its ohmic resistance. See chapter on alternating currents in Thompson's "Elementary Lessons," price $1.40 by mail. 3. Is a Daniell battery the best for general purposes and what are its faults for general uses? A. The Daniell's cell is not much in use at the present time. It has been superseded by the gravity cell, which has exactly the same elements and materials, except that no porous cup is used. For this reason the internal resistance of the gravity cell is less than that of the Daniell's cell. Its great value lies in the steadiness of the current it gives, because of its complete depolarization, so that it may remain in circuit throughout its life; its fault, if that term is admissible, is the small amount of current given. 4. How can I make a voltmeter with a fine compass and some No. 36 double-covered copper wire? A. A voltmeter is a galvanometer whose scale is marked in volts by comparison with a standard. Make your galvanometer and graduate it by some one's voltmeter. We should not advise a voltmeter made with a compass as an index. A coil of wire to swing in a magnetic field is the usual form employed. See SUPPLEMENT No. 1215, price ten cents.

(8213) I. S. W. asks: 1. Why will the earth act as return on a long circuit and will not do so on a short one? A. The earth will act as a return for a short circuit as well as for a long one, provided the ground is as good in one as in the other. 2. What is the voltage of the smallest shunt-wound dynamo used for lighting purposes, under the same conditions as enumerated on page 134, SCIENTIFIC AMERICAN, May 2, 1901? What size wind-mill would be required to run the above dynamo? 2. The ordinary voltage of incandescent lamps is from 52 to 115, and the dynamo must furnish the voltage of the lamps plus the drop in the line. The windmill in the account referred to had a wheel 35 feet in diameter and a sail area of 90 square yards. 3. Have thermo-electric piles been built giving 1 to 2 volts? A. Yes.

(8214) C. R. H. asks: Would ebonite be suitable for the plates of a Wimshurst machine? A. Yes.

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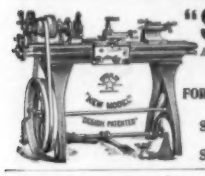

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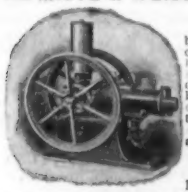

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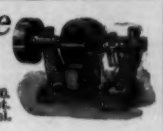

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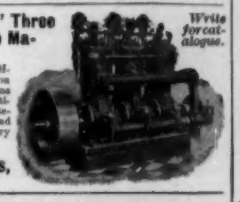

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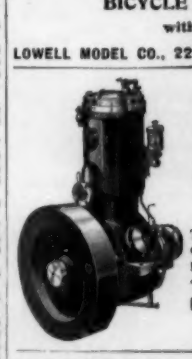

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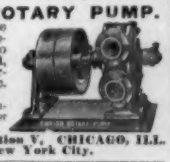

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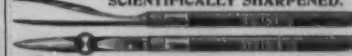

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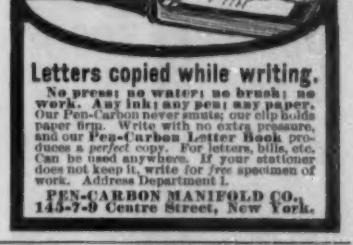

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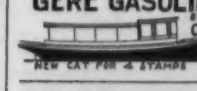

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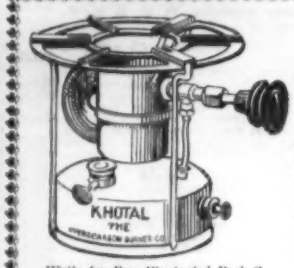

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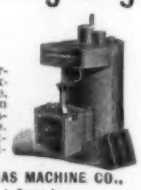

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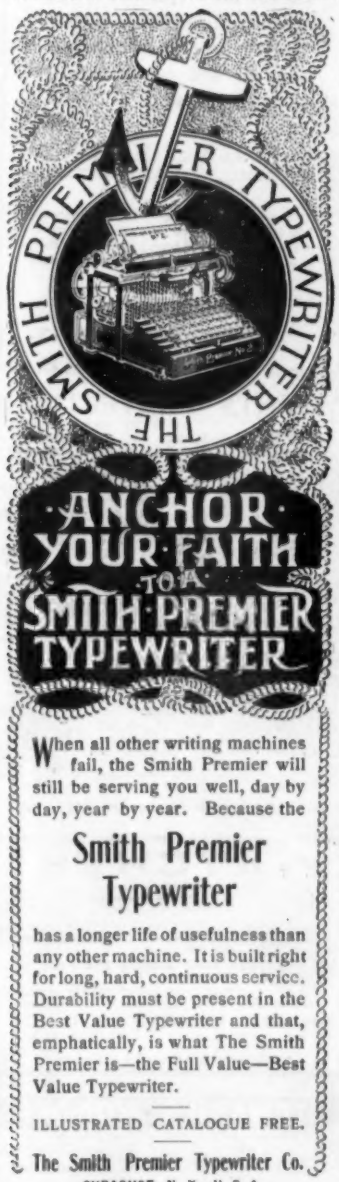

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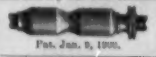

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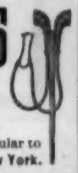

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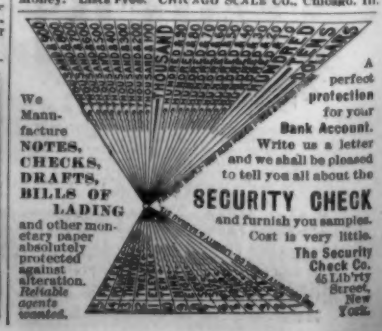

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